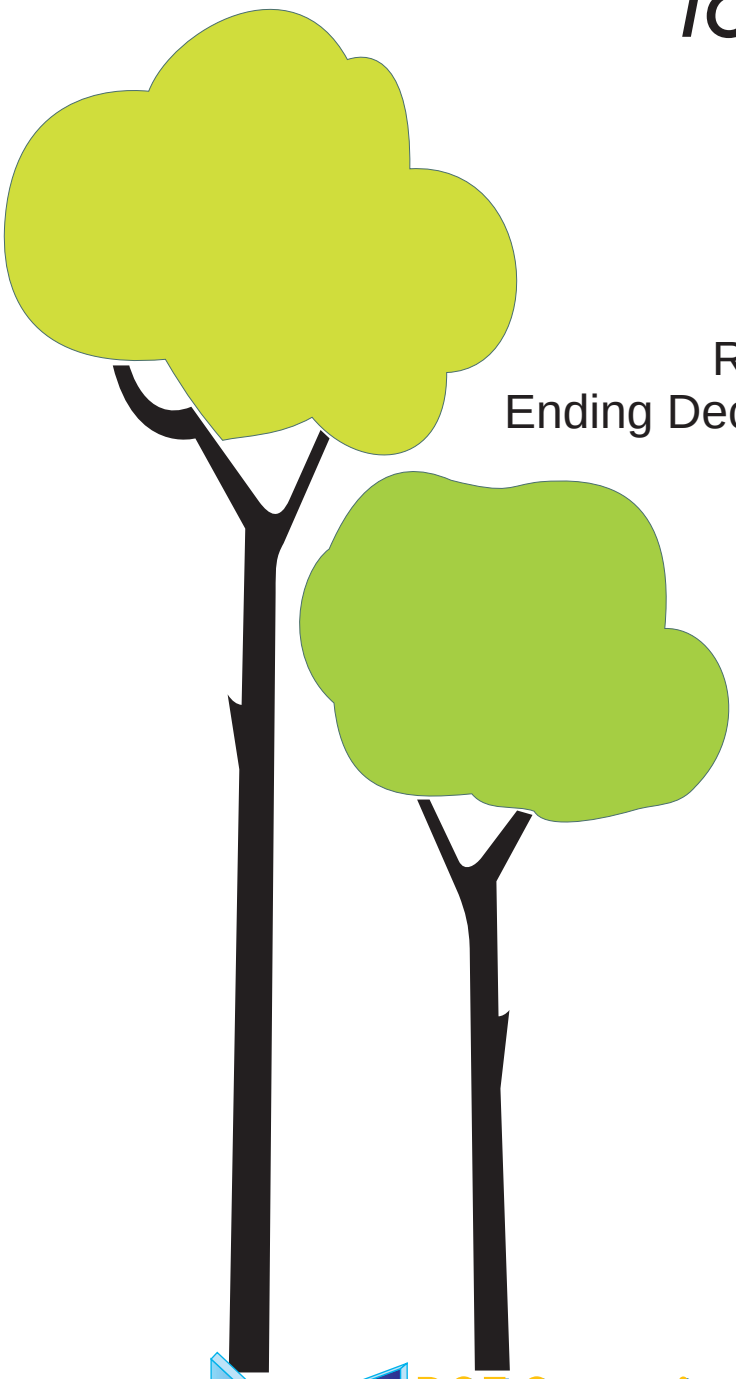
DOE/EH-0531(4Q96)

ES&H

Office of Environment, Safety and Health

Performance Indicators for ES&H



Report Period
Ending December 1996

June 1997

DOE Operating Experience Analysis

Safety Management Through Analysis

This report is available via the World Wide Web at: http://www.eh.doe.gov/pi

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Introduction

Vision

Several recent DOE workshops, such as Line Management Oversight of ES&H and Integrated Safety Management, exemplify the need for a good set of ES&H performance measures. In addition, all of our major site contracts now incorporate performance-based ES&H (as well as other) measures. This focus on measuring ES&H performance based on factual data is an important step toward effective ES&H management. Some sites have looked to this report as a starting point for their local measures. Two cautions are in order. First, the measures in this report were chosen based on their contribution to a corporate report card. They may or may not be significant for any particular local application. Second, the measures in this report to date were chosen from existing data streams such as ORPS, CAIRS, and site environmental reports. It may be both cost effective and beneficial to develop new measures at the local level, many which may not be interesting at the corporate level. As you develop new measures, please share them with us.

Data Availability

Five performance indicators and their accompanying analysis in this report are unchanged from the previous report due the inability to get updated information. These include radiation exposure (PI-10 and PI-11), spent fuel/plutonium vulnerabilities (PI-19), plutonium stabilization (PI-20), and toxic chemical releases (PI-21). In addition, one performance indicator we have promised, pollution prevention (PI-22), has yet to make an appearance. In some cases, the fix to this lack of information is to provide more automation—an option that may even reduce data collection/handling costs due to advances in information management technology. This is especially true where data collection is done by paper reports. In other cases, the fix may be to establish new processes to collect and forward the data—an area that must be approached cautiously to ensure cost-effectiveness. We are continuing to pursue these.

New Indicators

We have long recognized that the suite of performance indicators in this report is not complete. For example, we have few measures in the area of ES&H management, although the recent Integrated Safety Management process should give birth to some measures in this area. Measures of hazard reduction are increasing with the introduction of the Highly Enriched Uranium (HEU) vulnerability measure (PI-23) introduced in this report, but we are still lacking in this area. As we continue to improve our suite of corporate ES&H performance indicators, we welcome your input and ideas.

Assessments

As discussed in this report, we see some interesting trends:

- Both lost workday case rate and OSH cost index continue to exhibit favorable trends. Construction and security force related events remain the leading contributors to the cost index in 1996. Security and services operations were the leading contributors to lost workday case rate. (see PI-1 and PI-2)
- The number of environmental releases reportable to Federal, state, or local agencies continued its significant downward trend. Oil release events continue to lead this indicator. However, 96% of all oil released in 96Q4 was recovered. (see PI-7)
- The number of radiological events increased modestly in 96Q4. This increase is largely due to unknown legacy contamination. (see PI-12)
- Although near misses and safety concerns decreased significantly in 96Q4, electrical safety and construction events continue to be the leading contributors. (see PI-13)

- The number of open Defense Nuclear Facilities Safety Board (DNFSB) recommendations continued to decline for the fourth consecutive quarter. The number of open commitments associated with the recommendations likewise decreased from 436 in 96Q2 to 341 in 96Q4. (see PI-18)

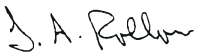
- DOE continues to meet only approximately 80% of its environmental compliance milestones. (see PI-17)

Detail Opportunities

During the past year, we have had four DOE field personnel detailed to our office for approximately 90 days each to work on performance indicator and operating experience analysis. We gain valuable field insight to improve our products and the detailees benefit from exposure to ES&H analysis techniques and become familiar with DOE headquarters activities. If your office wishes to nominate a person for this program, please contact us for more information.

On the Web

This report and additional analytical tools, techniques, and data can be found at our Internet web site. Please visit us at http://tis.eh.doe.gov/web/oeaf.



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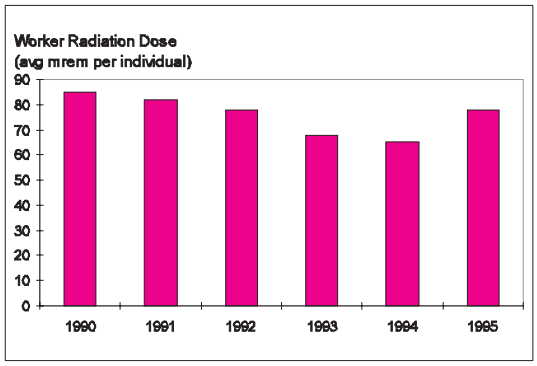
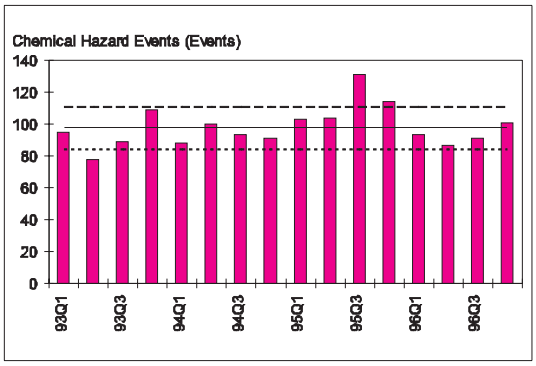
Management Summary

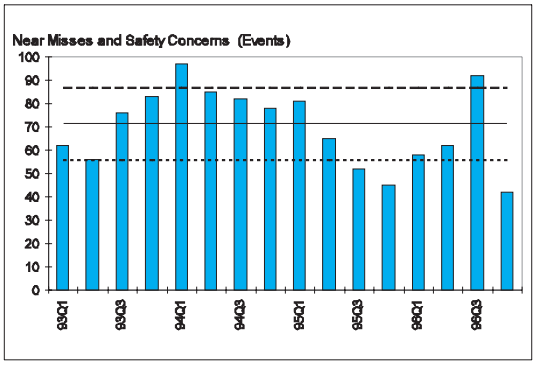
Six of the DOE Environment, Safety and Health Performance Indicators were selected this quarter to highlight below. Lost Workday Case Rate and Reportable Occurrences of Releases to the Environment are included in the Secretary of Energy's Key Indicators. The horizontal lines on the graphs represent the historical baseline ±1 standard deviation. Quarterly data is presented as calendar quarters. Trends are identified based on a statistical analysis of the data. A detailed discussion of the method [Multinomial Likelihood Ratio Test (MLRT)] is provided in the Glossary section of this report.



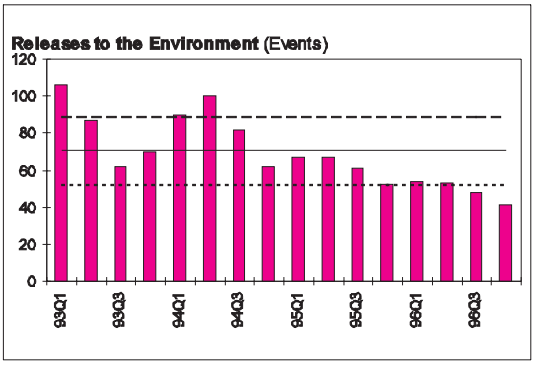
The average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.



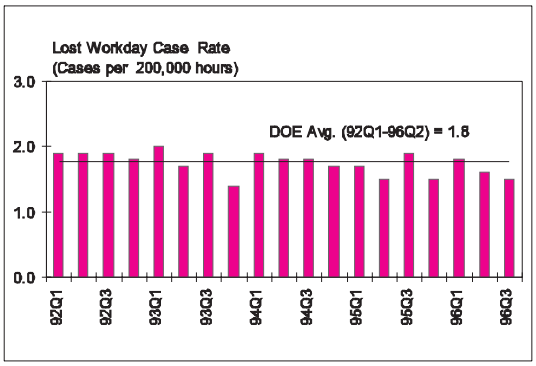
Number of events reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names.



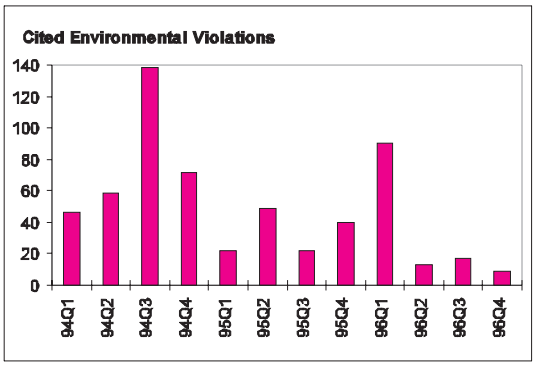
Number of events related to near misses or safety concerns reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information.*



Number of releases of radionuclides or hazardous substances or regulated pollutants that are reportable to federal, state, or local agencies.



A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both. Lost Workday Case (LWC) Rate is the number of lost workday cases per 200,000 hours worked.



Number of environmental violations cited by regulators in enforcement actions at DOE facilities.

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List of Performance Indicators

The performance indicators are organized into four major categories. The numbers correspond to the section numbers used in this report. Indicators appearing for the first time in this report are designated below as "[new]".

1. Accidents/Events that have already happened

Injuries, fatalities, releases, uptakes, etc.

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety
4. Industrial Operations Safety
5. Transportation Safety
6. Chemical Hazard Events
7. Reportable Occurrences of Releases to the Environment
8. Cited Environmental Violations
9. Environmental Permit Exceedances
10. Radiation Dose to the Public
11. Worker Radiation Dose
12. Radiological Events

2. Precursors to accidents and near misses

Events which resulted in significant reduction of barriers that are depended upon for safety.

13. Near Misses and Safety Concerns
14. Inadequate Procedures/Procedures Not Followed
15. Safety System Actuations
16. Safety Equipment Degradation

3. ES&H Management

Includes work planning, training, manager and worker involvement, and regulatory compliance.

17. Environmental Compliance Milestones Met
18. Open DNFSB Recommendations

4. Hazards level of material at risk

Working with the program offices and sites, we hope to show how DOE is reducing hazards and vulnerabilities.

19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved
20. Plutonium Stabilization
21. Toxic Chemical Releases
22. Pollution Prevention
23. HEU Vulnerabilities [new]

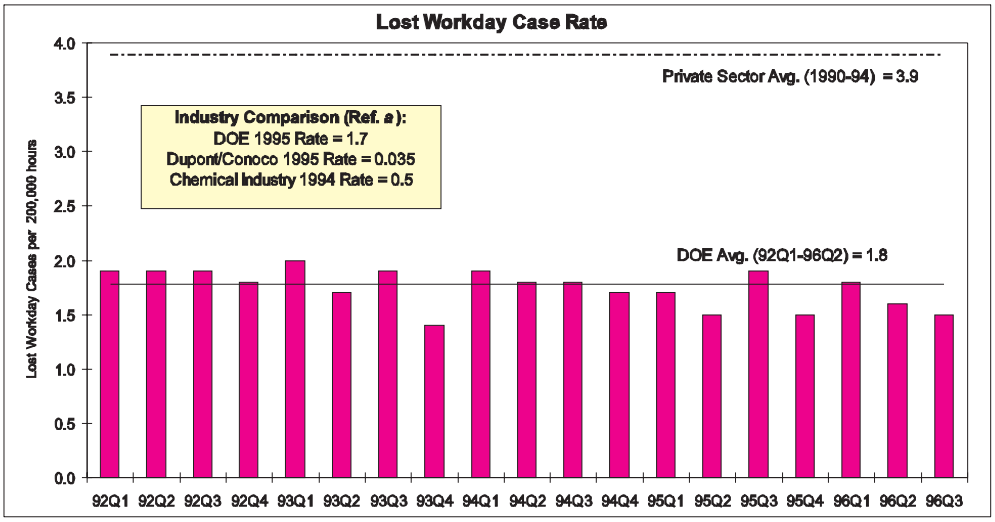
Indicator

1. Lost Workday Case Rate

Definition

A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both.

Lost Workday Case (LWC) rate is the number of lost workday cases per 200,000 hours worked.



Source: DOE Data - Computerized Accident/Incident Reporting System; Private Sector Data - Department of Labor, Bureau of Labor Statistics.

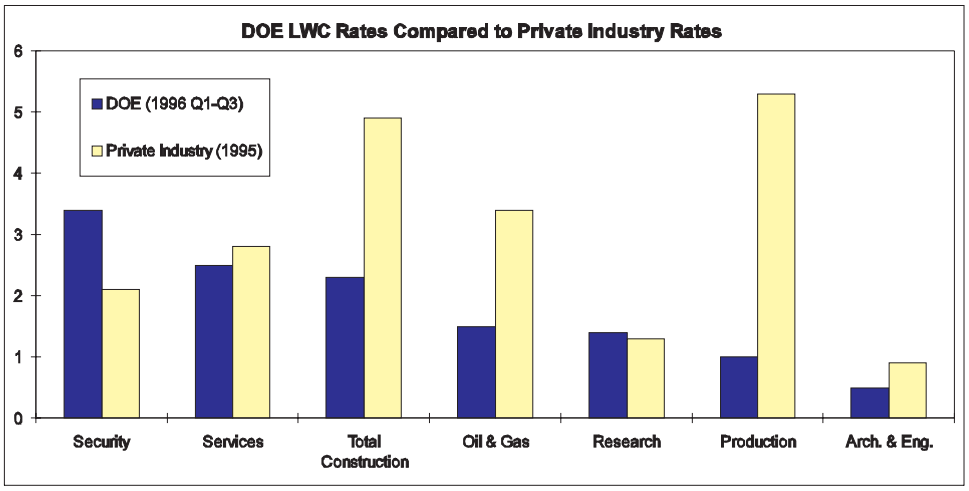
Key Observations

- LWC rates for the last four quarters fell at or below the average (92Q1-96Q2) of 1.8 cases per 200,000 hours worked. The LWC rate for the first three quarters of 1996, 1.6 cases per 200,000 hours worked, was 11% lower than the average.
- Preliminary estimates for the first three quarters of 1996 indicate that 1,686 cases were serious enough to cause either days away from work, days of restricted work activity, or both. DOE-wide, the average number of lost workdays per case for 96Q1 through 96Q3 was 21.8. The average number of lost workdays per case ranged from 26.3 for production operations to 6.0 for architectural and engineering operations.

Additional Analysis

- Lost workday cases continue to account for about 45% of total recordable cases.
- Year-to-date estimates show that during the first three quarters of 1996, research and services operations accounted for the largest proportion of lost workday cases, 35% and 26%, respectively. Security and services operations accounted for the largest lost workday case rates during the same time period.
- The Office of the Inspector General (IG) recently released a report on the processes used by three DOE contractors to record and report occupational injuries and illnesses. Based on the findings from this evaluation, the IG recommended several actions to validate current processes and to ensure consistency in the data reported. Following implementation of these actions, the Department will be in a better position to identify organizations with record keeping and reporting problems and what impact, if any, under or over reporting have had on overall statistics.

- Very general rate comparisons for some operation types can be made to the Department of Labor, Bureau of Labor Statistics (BLS) private industry classifications. The work performed by contractors for DOE falls into several industry classifications, including general building construction, manufacturing of chemicals and allied products, oil and gas extraction, research, security, and sanitary services. The graph shows a comparison of 1996 DOE LWC rates with 1995 private industry rates (the most recent BLS survey).



- Comparisons can be made to industries representing similar functions to DOE. For example, in 1995, the DOE LWC rate was 1.7, while the 1995 LWC rate for DuPont and its energy subsidiary, Conoco, was 0.035. In 1994, the chemical industry LWC rate was approximately 0.5. [a]

Reference

[a] *Safety, Health and the Environment 1995 Progress Report*, E.I. du Pont de Nemours and Company.

Indicator

2. Occupational Safety and Health Cost Index

Definition

In general terms, the DOE Occupational Safety and Health Cost Index represents the amount of money lost to injuries/illnesses for every hour worked by the total workforce. The Index is a coefficient calculated from the direct and indirect dollar costs of injuries. It is not a direct dollar value and is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. The index is computed as follows:

$$\text{Cost Index} = 100[(1{,}000{,}000)D + (500{,}000)T + (2{,}000)LWC + (1{,}000)WDL + (400)WDLR + (2{,}000)NFC] / HRS$$

where

D = the number of deaths,

T = the number of permanent transfers or terminations due to occupational illness or injury,

LWC = the number of lost workday cases,

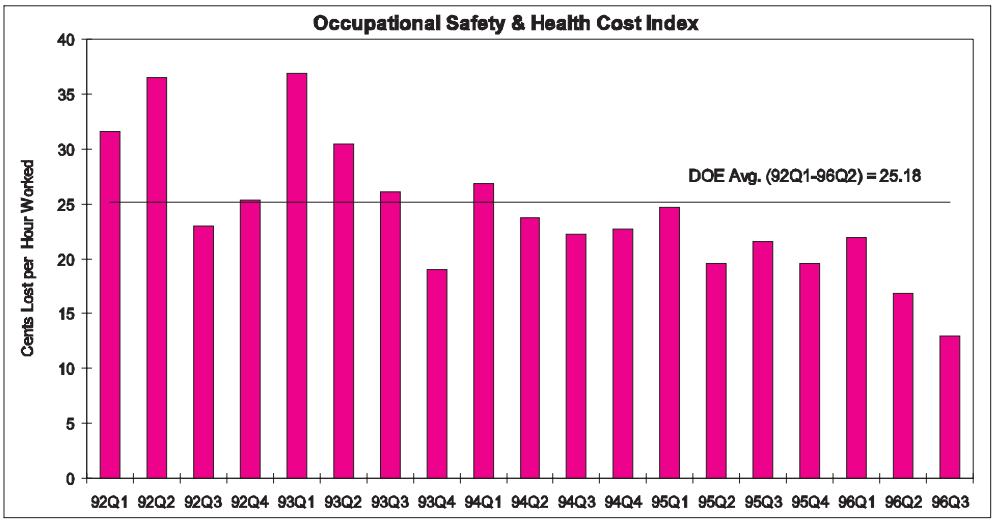
WDL = the number of days away from work,

WDLR = the number of restricted workdays,

NFC = the number of non-fatal cases without days away from work or restricted workdays, and

HRS = the total hours worked.

The coefficients are weighting factors which were derived from a study of the direct and indirect dollar costs of injuries.



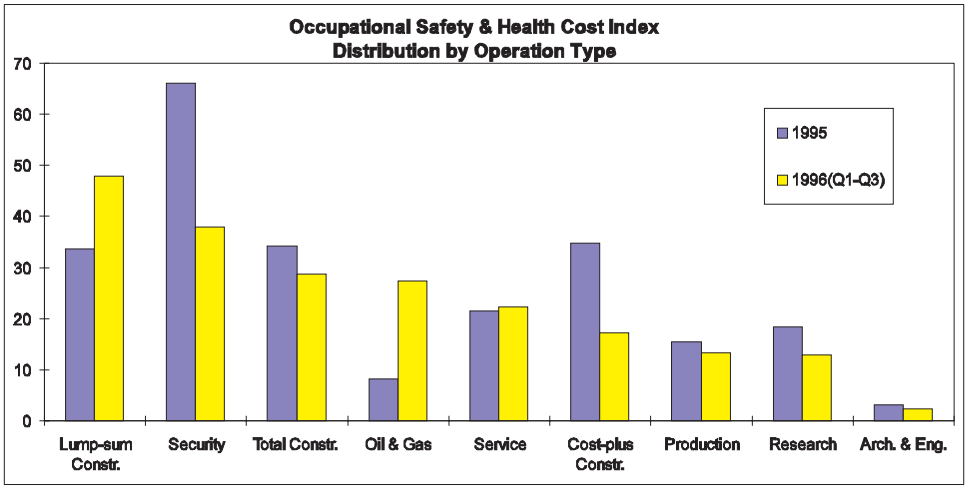
Source: Computerized Accident/Incident Reporting System

Key Observations

- The Cost Index for each quarter since 94Q2 fell below the average (92Q1-96Q2) of 25.18.
- The preliminary Cost Index for 1996 (based on data for 96Q1 through 96Q3) indicates that the downward trend since 1991 continues. Lost workday cases and

days-away-from-work cases have decreased since 1991, and days of restricted work activity have increased slightly. This may reflect field initiatives, such as, increased focus on reducing days away from work due to injuries. Revisions and late reporting are expected to result in increases in 1996 estimates.

- The cumulative Cost Index for DOE contractors has decreased each year since 1991. However, the index for each operation type has not been consistently declining. The highest Cost Index for 1995 was for security operations. Current 1996 estimates indicate the highest index is for lump sum construction. In 1995 and 1996, both of these operation types experienced fatalities, which has the highest weighting factor applied in the Cost Index calculation. One fatality occurred during the first three quarters of 1996. The construction-related fatality resulted in the highest Cost Index by operation type for lump sum construction. The graph shows the Cost Index distributed by Operation Type for 1995 and the first three quarters of 1996.

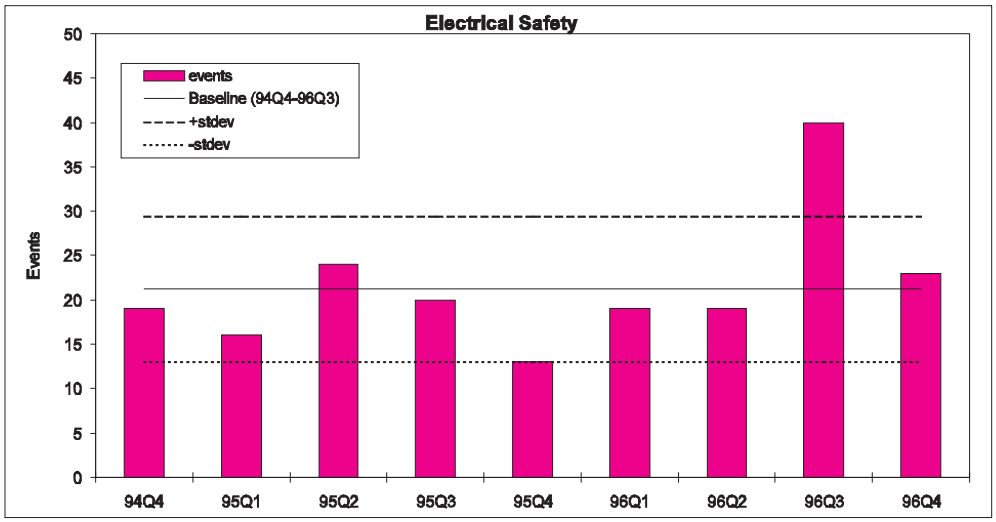


Indicator

3. Electrical Safety

Definition

The number of events involving worker contact or the potential for contact with electrically energized equipment. These events are reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department analysts.

Key Observations

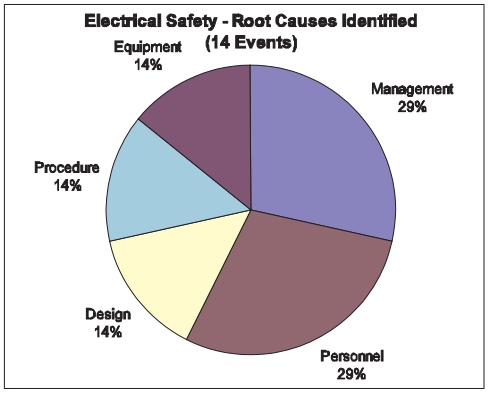
- The number of electrical safety events in the current quarter is significantly lower compared to the previous quarter.
- Of the 23 electrical safety events in the current quarter, only 4 involved a person actually sustaining a shock, and of these 4, no serious injuries requiring hospitalization were reported.

Additional Analysis

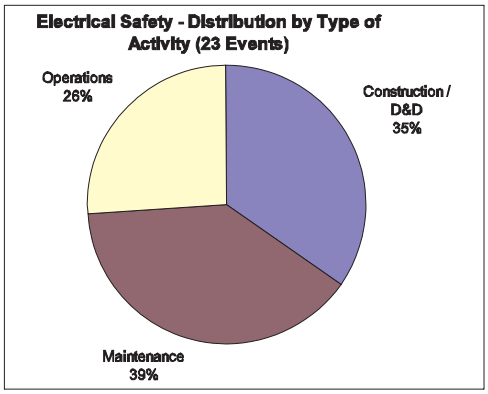
Distribution by Location:

- Except for the Hanford site reporting 6 events, the number of events is evenly distributed with no other site reporting more than 2 events. Interestingly, although Hanford reported more than 3 times that of any other site, only one actual shock is included in the Hanford reports.
- Richland Operations Office is aware of the number of electrical safety events this quarter, and they are monitoring the situation for trends and common causes. Richland reports that issues, such as increased work activity, will be looked at and correlated with the events. Although, the current quarter coincides with a change in contractor (Oct. 1, 1996, M&I contract awarded to Fluor Daniel) almost all personnel remain at their same duties.

Distribution by Root Cause: The following pie chart represents the distribution by root cause for the 14 electrical safety events in which the root cause has been identified.



Distribution by Type of Activity: Historically, many of the electrical safety events occur during 1) construction activities involving excavation and drilling and 2) maintenance activities involving failure to follow lockout/tagout procedures. The following pie chart represents the electrical safety events distributed by activity.

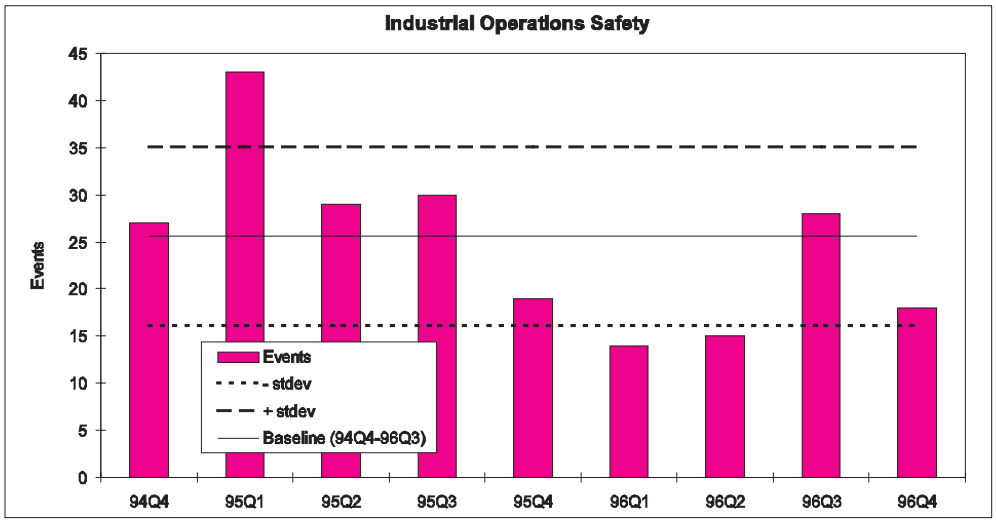


Indicator

4. Industrial Operations Safety

Definition

The number of operations-related events involving construction equipment, forklift operations, hoisting, rigging, or excavation reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department analysts.

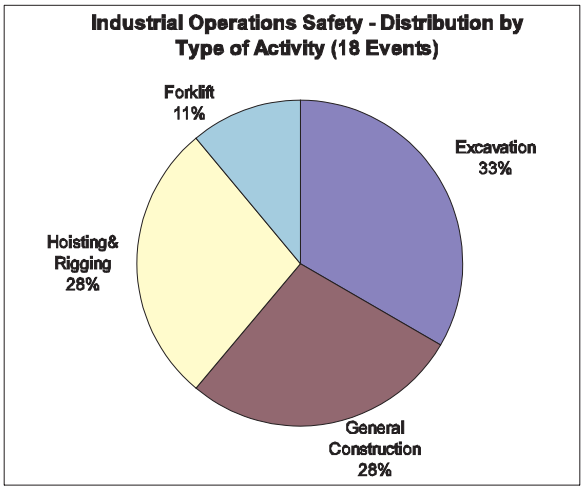
Key Observations

- Only one event in the fourth quarter of 1996 resulted in personal injury as compared with 2 personal injuries each for the last two quarters.

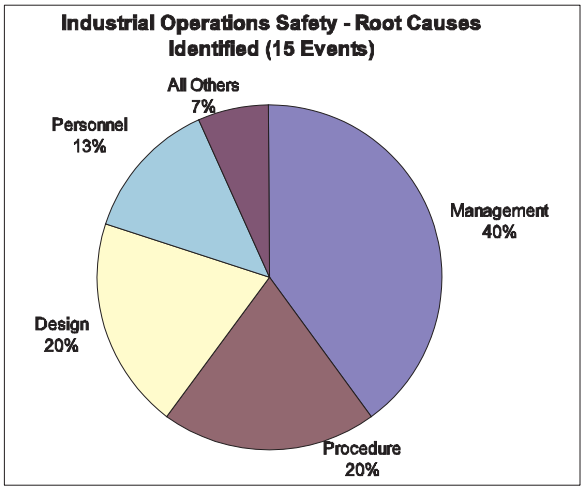
Additional Analysis

Distribution by Type of Activity:

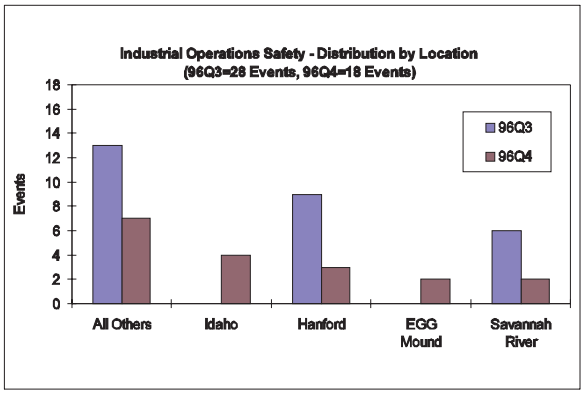
As shown in the graph, 61% (11 of 18 total events) of the industrial operations safety events in 96Q4 involved excavation operations or general construction activities. The same activities contributed only 36% (10 of 28 total events) in 96Q3. The largest reduction of reportable events was among the Hoisting & Rigging activities where the number of events dropped from 14 events in 96Q3 to only 5 in 96Q4.



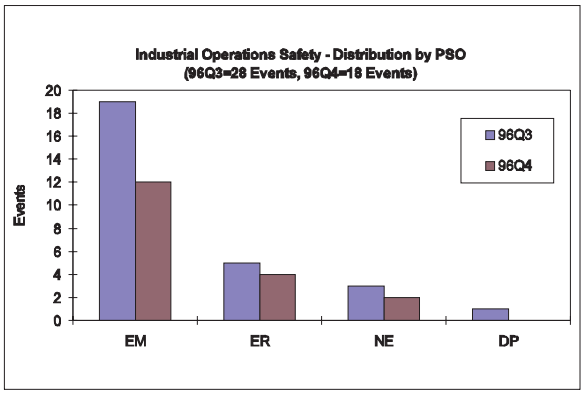
Distribution by Root Cause: The chart to the right depicts the distribution by root cause for the 15 industrial operations safety events in which the root causes have been identified.



Distribution by Location: The number of industrial operations safety events declined at Savannah River from 6 in 96Q3 to 2 in 96Q4. The number of events at Hanford declined from 9 to 3 between the two quarters. However, Idaho experienced 4 events in 96Q4 while no events were identified in 96Q3.



Distribution by PSO: The distribution by Program Secretarial Office (PSO) is shown below. For comparison, 96Q3 is also shown in parallel.

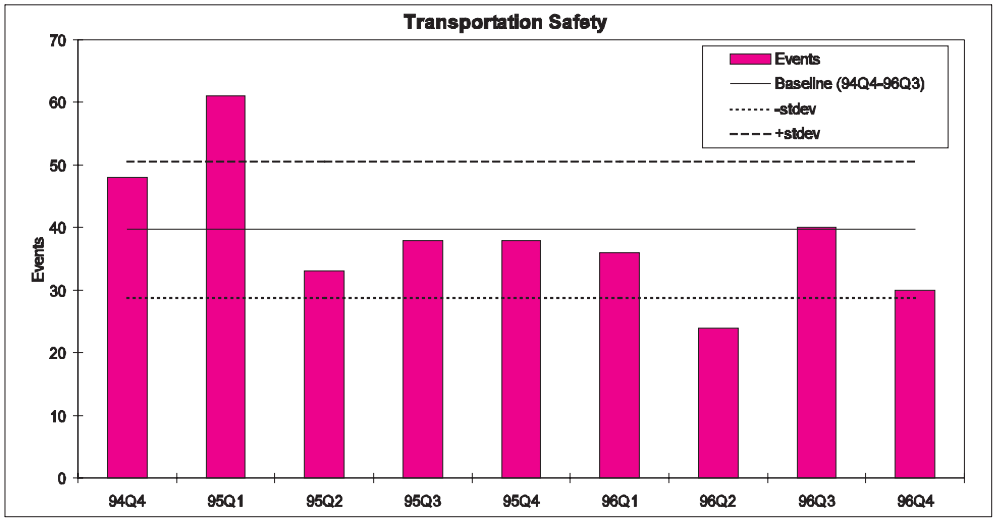


Indicator

5. Transportation Safety

Definition

The number of transportation-related events involving shipping issues and /or vehicular accidents including events related to loading and unloading. This data is derived from occurrences reported under DOE 232.1 Occurrence *Reporting and Processing of Operation Information*.



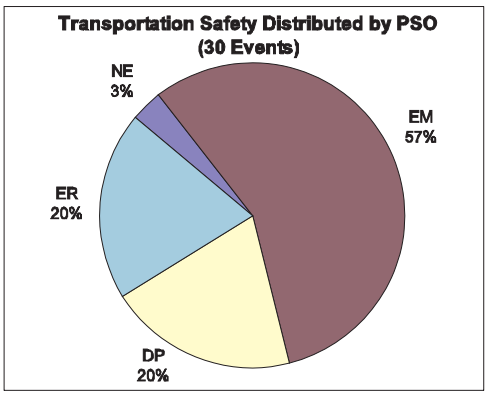
Source: Review of Occurrence Reports by Department analysts.

Key Observations

- During the last 7 quarters, (95Q2-96Q4), there has been no evidence of a trend in the number of transportation-related events reported across the DOE Complex.
- During 96Q4, transportation occurrences totaled 30; 20 (67%) were related to shipping issues and 10 (33%) involved vehicle accidents.

Additional Analysis

Distribution by PSO: The chart shows the distribution of transportation safety events by Program Secretarial Office (PSO).

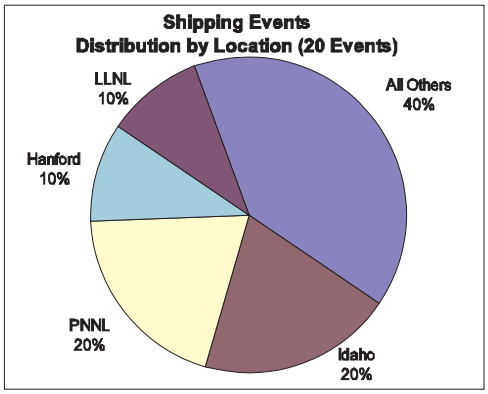


Shipping Events

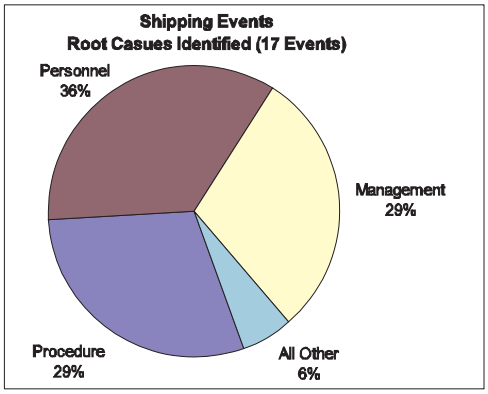
Definition: These occurrences include: 1) infractions/violations of DOT/DOE regulations governing the preparation of manifests involving: incorrect description of nuclear, hazardous and explosive materials, incorrect labeling, lack of placarding of containers and carriers transporting such materials and 2) use of incompatible/inappropriate packaging and containers.

- During the last 9 quarters there is a general decreasing trend in shipping events.

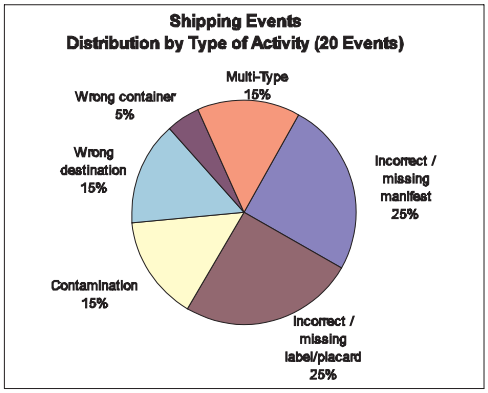
Shipping Events by Location: The chart depicts the distribution by location of the 20 shipping events reported in 96Q4. (Note: Lawrence Livermore National Laboratory - LLNL; Pacific Northwest National Laboratory - PNNL.)



Shipping Events by Root Cause: Personnel error, procedure violations, and management problems were the predominant root causes identified for shipping events.



Shipping Events by Type of Activity: The chart represents the distribution of shipping events by type of activity.



Vehicle Accidents

Definition: These events involve vehicular accidents, in which personnel injuries, fatality, and/or property damage and losses have incurred.

- The 10 accidents during 96Q4 are distributed over 8 sites.
- Injuries reported this quarter were of a minor nature. In one accident, a person received second-degree burns on his left hand.
- For the current quarter, tangible property loss was estimated at $30,850, which compares favorably with $50,116 reported for 96Q3.

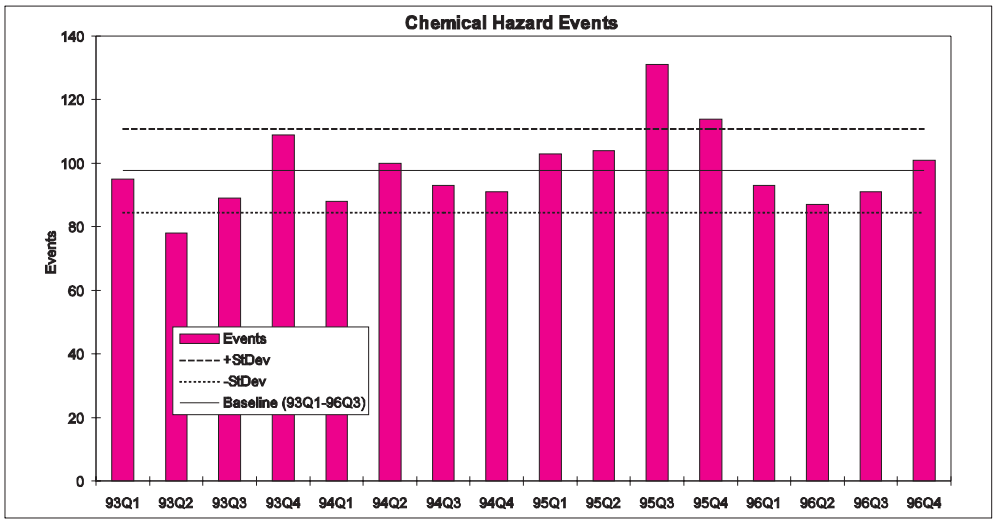
Indicator

6. Chemical Hazard Events

Definition

The number of events reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names. The selected events are reviewed and screened for conditions meeting one of the following categories:

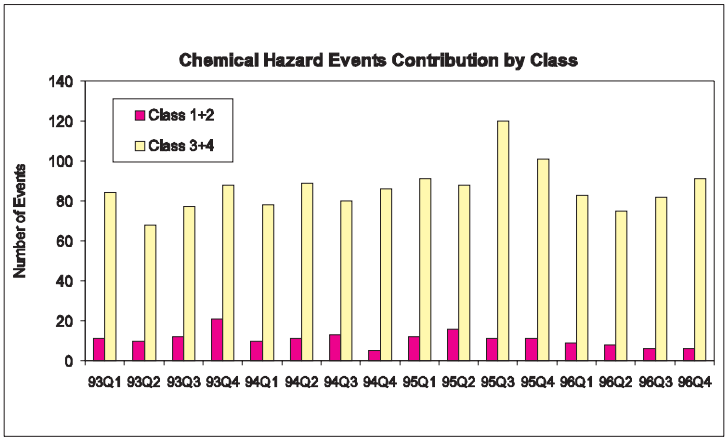
- Class 1 - An injury or exposure requiring hospital treatment or confirmed, severe environmental effect.
- Class 2 - Minor injury (first aid) or exposure, or minor environmental damage.
- Class 3 - Potential precursors to the occurrences in Class 1 or 2.
- Class 4 - Minor occurrences such as leaks, spills, or releases which are significant by the frequency, but not by the consequences.



Source: Chemical Safety Concerns: A Quarterly Review of ORPS October-December 1996. US Department of Energy, Office of Field Support, EH-53.(draft as of 1-23-97). World Wide Web at: http://www.dne.bnl.gov/etd/csc/

Key Observations

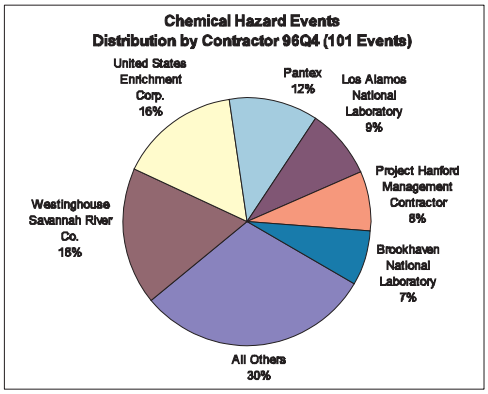
- After decreasing since 95Q3, the number of chemical hazard events has risen slightly in 96Q3 and 96Q4.
- Class 3 and 4 (less severe) events comprise 89% of the overall chemical hazard events identified over the last 16 quarters. During this time period, there is an increasing trend in the number of Class 3 and 4 events and a decreasing trend in the number of Class 1 and 2 events based on MLRT analysis.



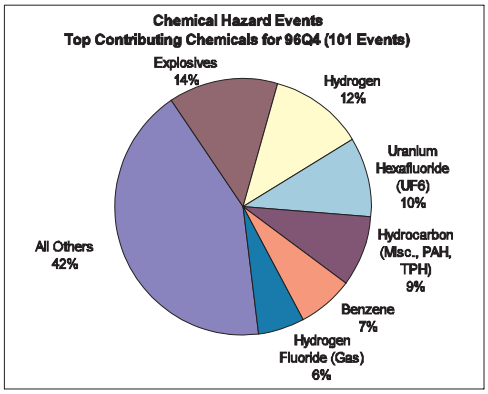
Additional Analysis

Characterization of Chemical Hazard Events: During 96Q4, two Class 1 events and four Class 2 events were identified. One Class 1 event involved a chemical oven explosion; the other Class 1 event involved a molten salt spray from a damaged chemical reaction vessel. Two Class 2 events involved worker exposures (sulfur dioxide and nitrogen dioxide), one Class 2 event involved worker burns from sodium hydroxide, and one Class 2 event involved a worker sprayed with a cleaning solution.

Distribution by Location: The major contributors in 96Q4 are identified in the chart. The largest percentage of chemical hazard events occurred at Savannah River, United States Enrichment Corp. (USEC), and Pantex. Since 95Q1, there is a decreasing trend in the number of chemical hazard events observed at Savannah River based on MLRT analysis. Over the same time period, there is an increasing trend in the number of events at Pantex. The number of chemical hazard events at USEC dropped from 44 in 95Q4 to 10 in 96Q1, which may reflect implementation of an agreement that USEC no longer is required to report off-normal events to DOE.

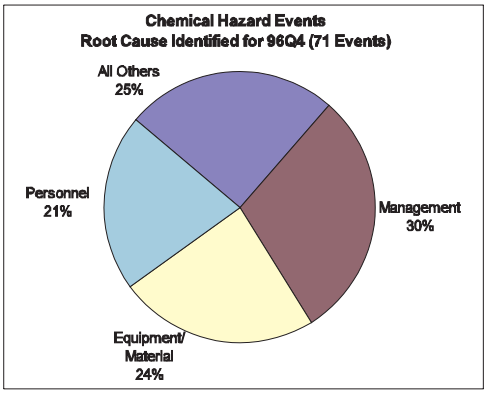


Distribution by Chemicals Involved:



- The chemicals most often involved in chemical hazard events (i.e., top contributing chemicals) during 96Q4 are identified in the chart. Explosives, hydrogen, and uranium hexafluoride (UF6) were the leading contributors. Explosives events took place almost exclusively at Pantex, Los Alamos National Laboratory (LANL), and Lawrence Livermore National Laboratory (LLNL) and were Class 3 or 4. Hydrogen events occurred largely at Savannah River and were Class 3 or 4.
- UF6 was involved in only 4% and 10% of the total chemical hazard events identified during 96Q3 and 96Q4, respectively. The percentage of the total chemical hazard events involving UF6 has decreased since 95Q4, when it was 30% of the total. This decrease corresponds with implementation of an agreement that USEC no longer is required to report off-normal events to DOE.

Distribution by Root Cause: The root cause distribution for 96Q4 is shown in the chart. 75% of root causes identified were management problems, equipment/material problems, or personnel errors.



Lessons Learned: Significant occurrences (Class 1 and 2) continue to feature the importance of adequate hazard analysis and hazard communication in preventing chemical safety occurrences. Adequate, effective training (and refresher training) for operations, maintenance, and (especially) emergency response is stressed.

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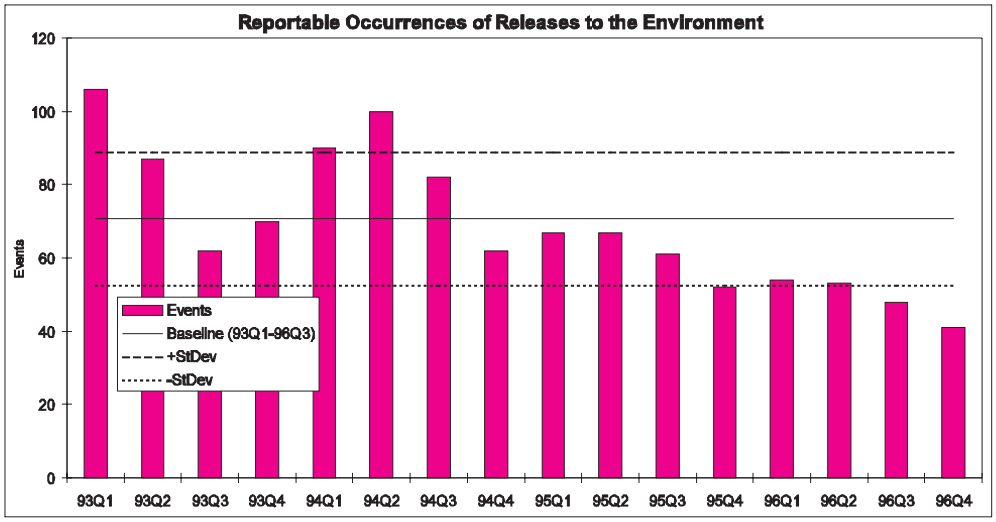
Indicator

7. Reportable Occurrences of Releases to the Environment

Definition

Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



Source: Review of Occurrence Reports by Department analysts.

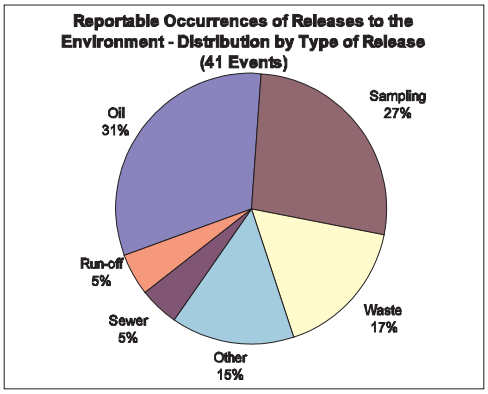
Key Observations

- Reportable release incidents continue to show a significantly decreasing trend over the last 15 quarters.
- The decrease from 96Q3 to 96Q4 (48 to 41) is very significant because the rate of decrease was relatively moderate over the past 8 quarters, decreasing from 67 in 95Q1 to 48 in 96Q3.

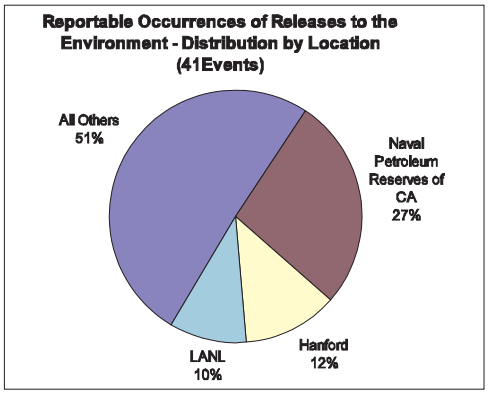
Additional Analysis

- Unlike other indicators based on occurrence reports, releases to the environment are heavily influenced by the wide variations in reporting requirements from state to state; for example, a particular event may be reportable in one state but not in another.

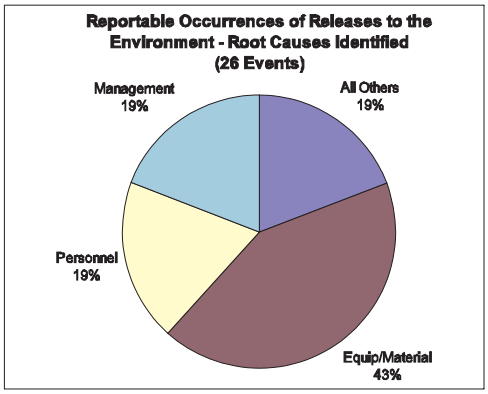
Distribution by Type of Release: Various types of releases for 96Q4 are shown in the graph. Petroleum products remain the predominant source of events. The eleven petroleum events occurred at the Naval Petroleum Reserve. The total amount of oil spilled this quarter by the Naval Petroleum Reserve was 878 barrels; however, 839 barrels (96%) were reported to have been recovered for a net spillage of 39 barrels.



Distribution by Location: During the current quarter, the 41 environmental release events were distributed over 16 locations. Six locations contributed only 1 event. Only 2 locations contributed 5 or more events. Except for the fact that the Naval Petroleum Reserve is a consistently large contributor, there are no real trends because the number of events per site is relatively low.



Distribution by Root Cause: The leading Root Cause identified for release events in 96Q3 and again in 96Q4 is the equipment/material category. In the current quarter, there were 11 equipment/material root causes identified. However, 10 of these root causes were for the 11 Naval Petroleum Reserve events. If Naval Petroleum Reserve events are excluded, personnel and management problems are the dominant root causes, which has been the historical trend.

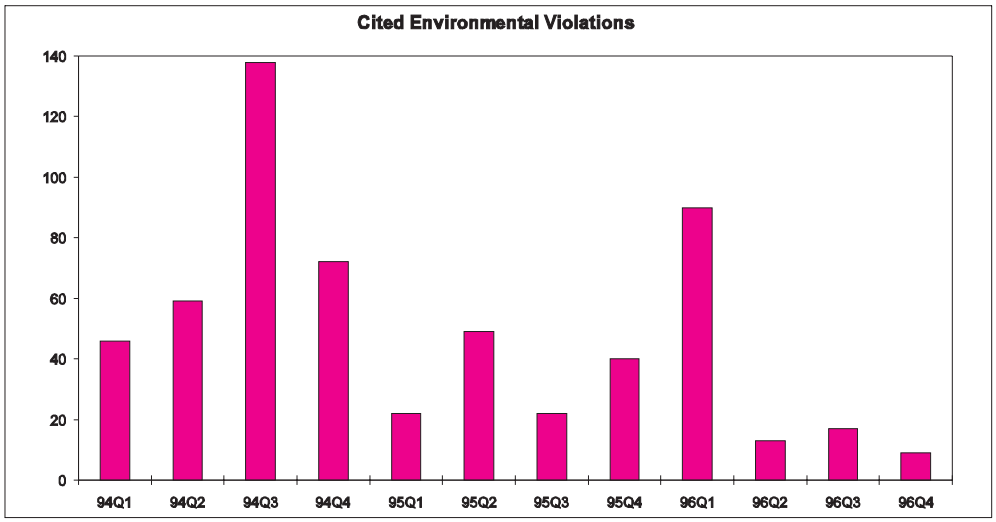


Indicator

8. Cited Environmental Violations

Definition

Number of environmental violations cited in enforcement actions by regulators at DOE facilities.



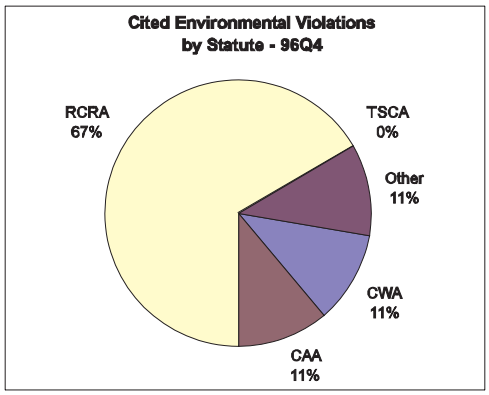
Source: EH-41 Compliance Database

Key Observations

- The number of environmental violations cited at DOE facilities in 1996 (129) was comparable to 1995 (133).
- The 90 violations in the first quarter of 1996 include 63 at Idaho.
- The Resource Conservation and Recovery Act (RCRA) accounts for at least two-thirds of the cited violations in each of the last four quarters.

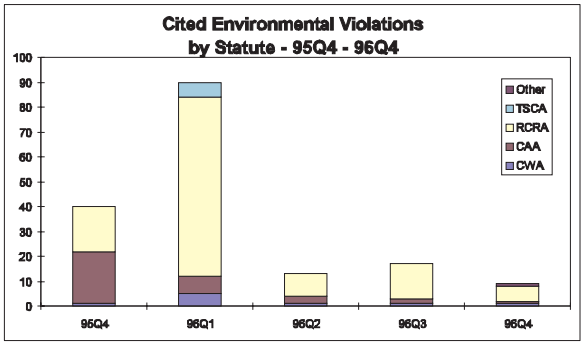
Additional Analysis

- Totals previously reported for 95Q4 through 96Q3 have been revised to reflect updated data.
- The majority of the violations are related to the following statues:
  - Resource Conservation and Recovery Act (RCRA),
  - Clean Air Act (CAA),
  - Clean Water Act (CWA), and
  - Toxic Substances Control Act (TSCA).



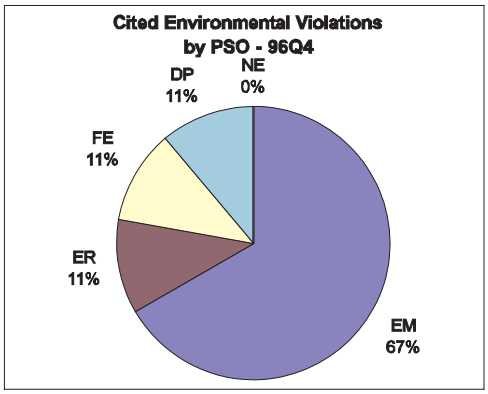
Violations by Statute

RCRA accounts for more than two-thirds of the violations cited in each quarter of 1996.



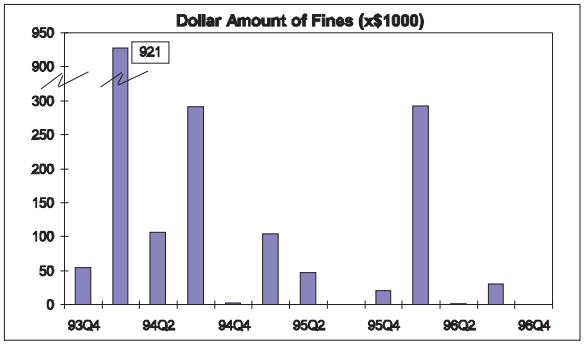
Violations by Program Office

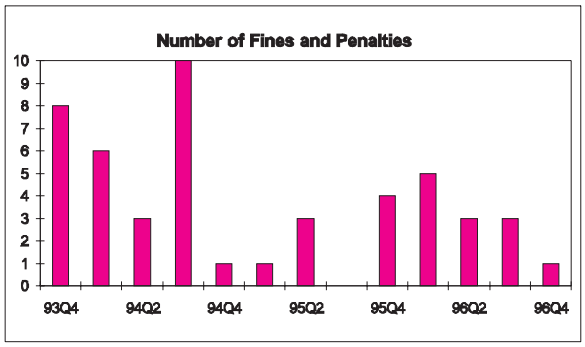
Two-thirds of the violations cited in 96Q4 were for activities at Hanford under the Office of Environmental Management (EM).



Amount of Fines and Number of Fines

- The only fine assessed in 96Q4 was $50.00 under the CAA.
- The reported amounts and numbers of fines for the previous four quarters have increased since the last report, based on updated data.
- Fines of $10,000 or more assessed between 95Q4 and 96Q3 include 5 under RCRA (including one of $167,000 at Idaho) and 1 under TSCA.



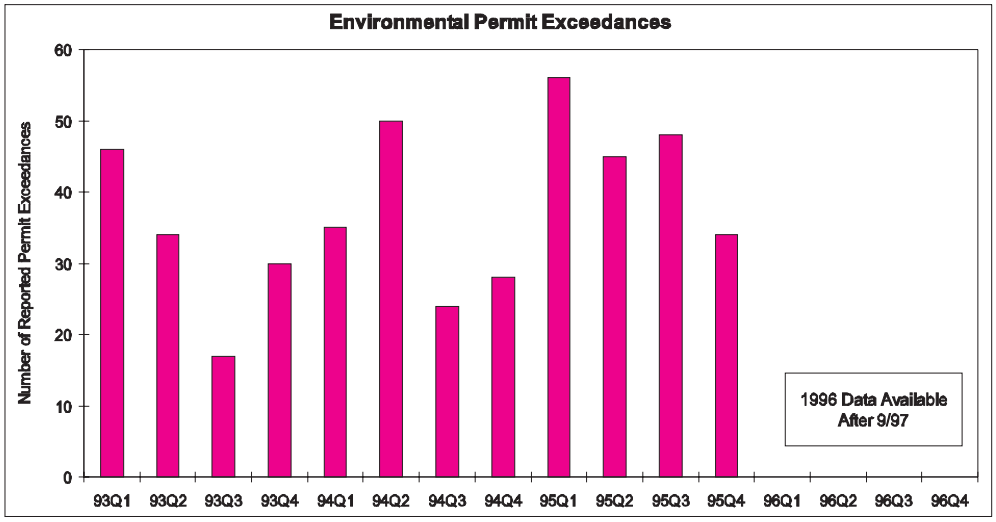


Indicator

9. Environmental Permit Exceedances

Definition

Exceedance of release levels specified in air and water permits during the quarter.



Source: Annual Site Environmental Reports, additional site data.

Key Observations

- The number of permit exceedances has increased each year from 1993 through 1995.
- In 1995, as in previous years, the great majority (94%) of exceedances are due to violations of permits under the Clean Water Act for discharge to surface waters.
- A few sites account for the majority of DOE's permit exceedances. In 1995, six sites accounted for more than half of the permit exceedances. From 1993 through 1995, five facilities accounted for more than half of the permit exceedances.

Additional Analysis

- Most exceedances (94%) continue to occur under National or State Pollution Discharge Elimination System Permits mandated by the Clean Water Act to protect surface waters by limiting effluent discharges to receiving streams, reservoirs, ponds, etc.
- Other permit exceedances occurred under Clean Air Act permits (3%) and ground-water discharge permits (3%).
- Over the three-year period 1993-1995, five sites accounted for more than half of the exceedances, and 9 sites accounted for 70% of the exceedances. In 1995, six sites (although not the identical list) accounted for more than half of the permit exceedances.
- Six sites had exceedances in at least 10 of the 12 quarters reported; however, two of these sites showed significantly fewer exceedances than in the previous two years.

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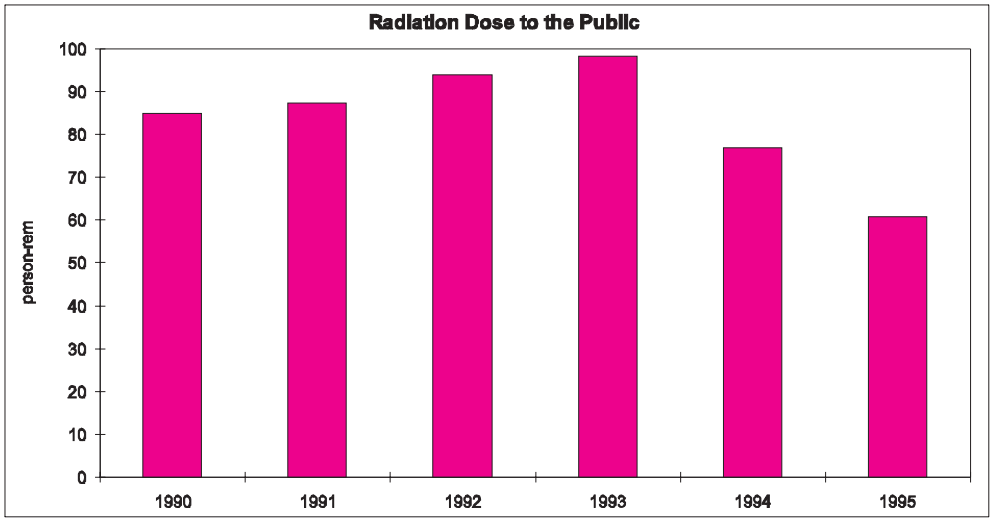
Indicator

10. Radiation Dose to the Public

Definition

Total collective radiation dose (person-rem) to the public within 50 miles of DOE facilities due to radionuclide airborne releases. ("Collective radiation dose" is the sum of the effective dose equivalent to all off-site people within a 50-mile radius of a DOE facility over a calendar year.)

No new data were available for this report.



Source: Annual reports to EPA; EH-41 preliminary tabulation.

Key Observations

- Total collective radiation dose to the public from DOE sources is very low compared to the public dose from natural background radiation. The total collective radiation dose to the public around DOE sites from air releases is one ten-thousandth of the dose received by the same population from natural background radiation.
- Total collective radiation dose to the public in 1995 decreased 21% from the previous year.
- Based on corrected data, total collective radiation dose to the public decreased 22% from 1993 to 1994.
- The decrease in collective radiation dose in 1995 reflects decreases in the dose from Oak Ridge, Lawrence Livermore Site 300, and Savannah River; in 1994 these sites accounted for almost 68% of the dose.

Additional Analysis

- In 1994, Oak Ridge, Lawrence Livermore Site 300, and Savannah River accounted for almost 68% of the total dose.
  - In 1995, the dose from Savannah River was 22% the dose reported in 1994; a decrease of 12.5 person-rem. The reduction was due to operational changes at the Replacement Tritium Facility (RTF). The RTF had decreases in tritium oxide emissions and decreases in tritium processing.
  - In 1995, the dose from Lawrence Livermore Site 300 was 45% the dose reported in 1994; a decrease of 9.3 person-rem. The reduction reflects a lower level of operation at the Building 513 Stabilization Unit.

  - In 1995, the dose from the Oak Ridge Reservation was 63% the dose reported in 1994; a decrease of 7 person-rem. The reduction is due to operational changes at the Y-12 plant.

- While the dose from several other sites increased from 1994 to 1995, there was still a net decrease of 21% below the 1994 population dose.
- An increase of 7.8 person-rem in the calculated dose from Lawrence Berkeley National Laboratory appears to reflect the use of local wind data for 1995 instead of Oakland Airport data as in previous years.

Indicator

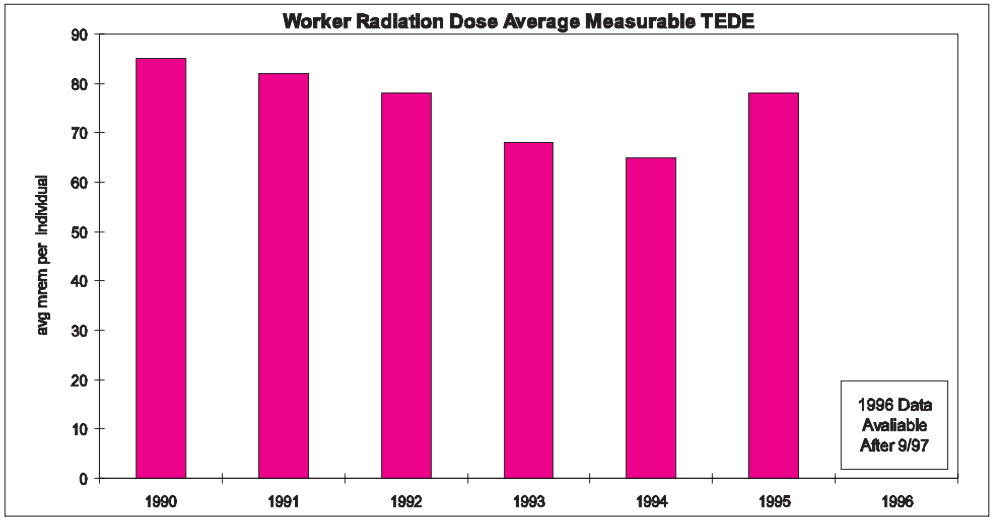
11. Worker Radiation Dose

Definition

The average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.

TEDE is determined by combining both internal and external contributions to an individual's occupational exposure. The number of individuals receiving measurable dose is used as an indicator of the exposed workforce size. It includes any individual (federal employees, contractors, subcontractors, and visitors) with reported doses greater than the minimum detectable dose.

No new data were available for this report.



Source: DOE/EH-52 and DOE Occupational Radiation Exposure Report 1995, DOE/EH-52, U.S. Department of Energy, December 1996 draft.

Key Observations

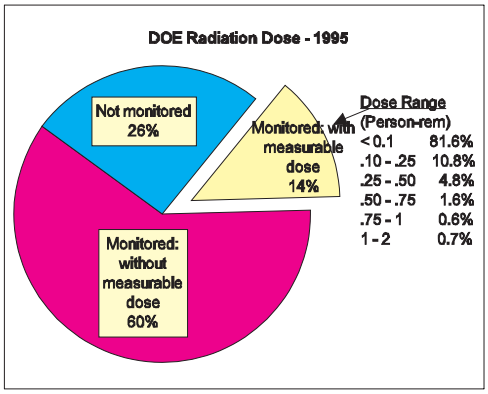
- The average TEDE per individual with measurable exposure decreased from 85 mrem in 1990 to 78 mrem in 1995. For comparison, the average exposure for the U.S. population from medical diagnostic x-rays is about 40 mrem.[a]
- For the first time in six years, average radiation dose per person is increasing. A good portion of this increase in 1995 is attributed to increased decontamination and decommissioning work.
- 80% of the collective TEDE is accrued at just six of the highest-dose DOE sites: Savannah River, Rocky Flats, Hanford, Los Alamos, Idaho, and Brookhaven.
- Occupational radiation dose reported by DOE has been impacted over the past 5 years by changes in operational status of DOE facilities, reporting requirements, and radiation protection standards and practices.

Additional Analysis

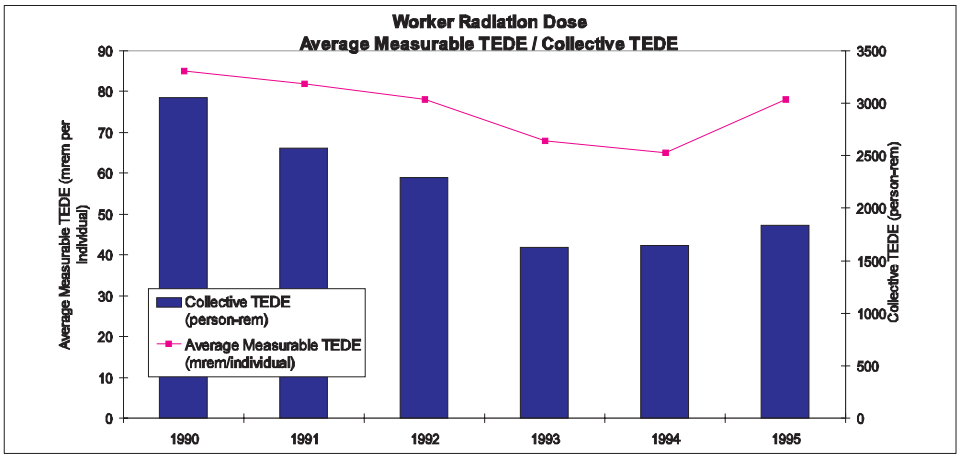
Additional information concerning exposure received by individuals associated with DOE activities are included in the DOE Occupational Radiation Exposure Report 1995 (December 1996 draft).

DOE Doses

- In 1995, 74% of the 172,178 DOE workers and contractors were monitored; 19% of those monitored received a measurable dose.
- No individuals exceeded the DOE limit of 5 rem or the administrative control level (ACL) of 2 rem in 1995. 92% of the workers with a measurable dose received a dose of less than 0.25 rem. Doses in excess of the ACL and the DOE TEDE dose limit have decreased over the past 6 years. Most of this decrease is because of the change in methodology for determining internal dose discussed below.



- The collective TEDE (the sum of the TEDE received by all monitored individuals) for 1995 was 1834 person-rem. The graph below indicates the decline in both average dose and collective dose.



Distribution by Site

The six leading contributors to the collective TEDE for 1995 comprised 80% of the total DOE dose. Five of the six sites reported increases which resulted in a 12% increase in the DOE collective dose from 1994 to 1995. The sites provided the following information on activities that contributed to the collective dose for 1995.

- Los Alamos: Most of the 24% increase (from 190 to 235 person-rem) was attributed to increased work on the production of power sources for NASA.
- Brookhaven: Most of the 58% increase (from 92 to 146 person-rem) is attributed to an 82% increase in the days of operation and intensity of the Alternating Gradient Synchrotron accelerator. Increased frequency of maintenance surveys conducted on aging equipment was also a contributing factor.
- Idaho: Most of the 20% increase (from 237 to 284 person-rem) is attributed to increased operations at Idaho Chemical Processing Plant (ICPP). Two key ICPP facilities were deactivated in 1995.
- Rocky Flats: Most of the increase (from 232 to 261 person-rem) is attributed to increased decontamination/decommissioning activities and material

stabilization work. Consolidation of special nuclear material and processing of potentially unstable residues for safe storage began in 1995.

- Hanford: Most of the increase (from 215 to 291 person-rem) is attributed to increased use of the tank farm and K Basins associated with nuclear material and facility stabilization.
- Savannah River: The site collective TEDE decreased 19% from 1994 to 1995 (from 315 to 256 person-rem). Operations at the major facilities were about the same in 1995 as in 1994. The Defense Waste Processing Facility (which represented 5% of Savannah River's total in 1994) was restarted near the end of 1995.

Comparison to Other Sources

- As a basis of comparison, the average Occupational Radiation Exposure received by shipyard personnel associated with the Naval nuclear propulsion program was 98 mrem per individuals with measurable dose for 1994 versus 65 mrem for DOE in 1994 and 78 in 1995.[b] Table 1 provides 1995 average occupational exposures for workers with measurable doses for Nuclear Regulatory Commission licensees.

TABLE 1
Comparison to 1995 Average Occupational Exposures for Workers with Measurable Doses[c]

License Category	Average Measurable TEDE per Worker (rem)
Industrial Radiography	0.54
Manufacturing and Distribution	0.49
Low-level Waste Disposal	0.14
Independent Spent Fuel Storage	1.04
Fuel Fabrication and Processing	0.43
Commercial Light Water Reactors	0.31

- The average radiation worker dose received from DOE operations in 1995 was 78 mrem per individual. This should be contrasted to background radiation levels of 27 mrem per individual from cosmic radiation, 28 mrem per individual from terrestrial sources, and 200 mrem from naturally occurring radon sources.[d]

Changes Impacting DOE Occupational Radiation Dose

- Change in operational status of facilities is the predominant driver behind changes in the collective dose. Significant reductions in the opportunities for individuals to be exposed occur as facilities are shut down and transitioned from operation to stabilization or decommissioning and decontamination.
- Changes to reporting requirements have significantly impacted the collective dose at DOE. The change in internal dose methodology from annual effective dose equivalent (AEDE) to committed effective dose equivalent (CEDE) between 1992 and 1993 resulted in a reduction of the collective TEDE by 28%, because the dose from prior intakes is no longer reported.
- Radiation protection practices have changed because of the implementation of the Radiological Control Manual (RadCon Manual). The RadCon Manual changed the methodology to determine internal dose, established Administrative Control Levels (ACL), standardized radiation protection programs, and formalized "As Low As Reasonably Achievable" (ALARA) practices.

References

[a] *Exposure of the U.S. Population from Diagnostic Medical Radiation,* National Council on Radiation Protection and Measurements, NCRP Report No. 100, Bethesda, MD, May 1989.

[b] *Occupational Radiation Exposure from U.S. Naval Nuclear Plants and Their Support Facilities*, Naval Nuclear Propulsion Program, Department of the Navy, Washington, DC, Report NT-95-2, March 1995.

[c] M.L. Thomas, D. Hagemeyer, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities*, NUREG-0713, Vol. 17, Draft, October 1996.

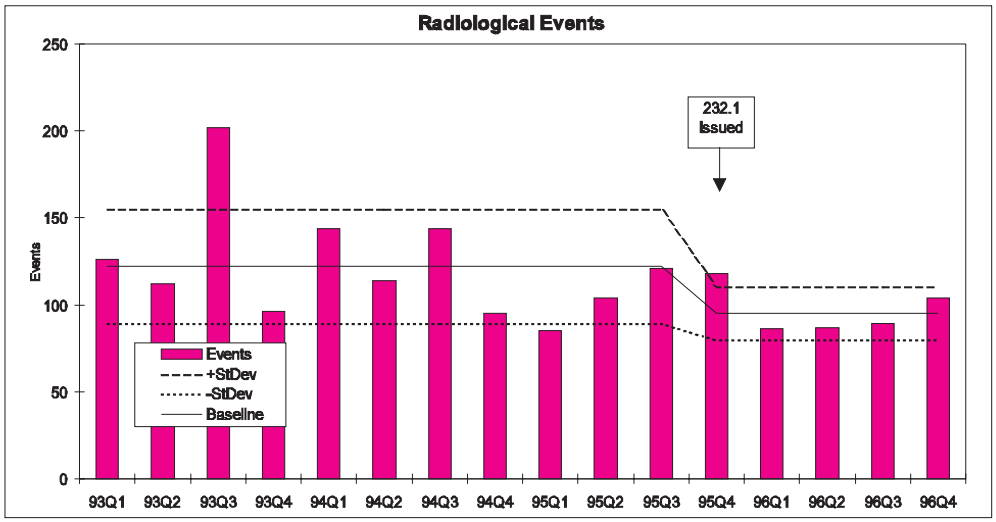
[d] Merril Eisenbud, Environmental Radioactivity from Natural, Industrial and Military Sources, 3rd Edition, by Academic Press, Inc.,1987.

Indicator

12. Radiological Events

Definition

The number of personnel contaminations and radiation exposures that are reported under DOE Order 232.2, *Occurrence Report and Processing of Operations Information.*



Source: Review of Occurrence Reports by Department analysts.

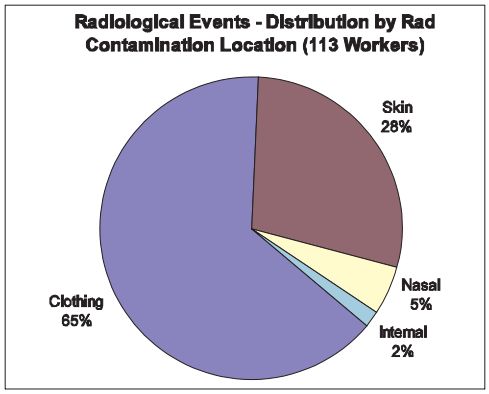
Key Observations

- A decreasing trend exists over the 16 quarters shown. The most recent 4 quarters, since the implementation of DOE Order 232.1, demonstrate a reduced number of radiological events when compared to the historical baseline and appear to have no significant trend.
- 113 individuals were involved in the 104 reported radiological events during 96Q4. Of the events reported in 96Q4, only 5 involved the contamination of more than one individual.

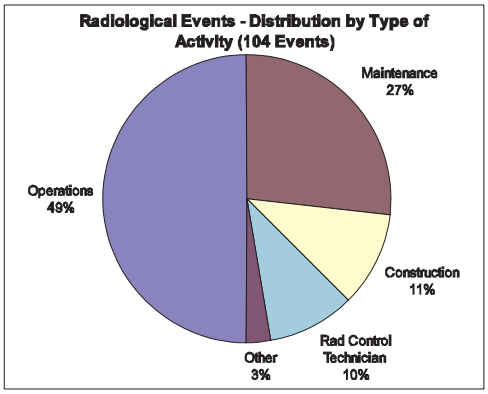
Additional Analysis

Distribution by Type of Activity

- The events reported in 96Q4 were analyzed as to the location on the individual that the contamination occurred. The following chart depicts this analysis.



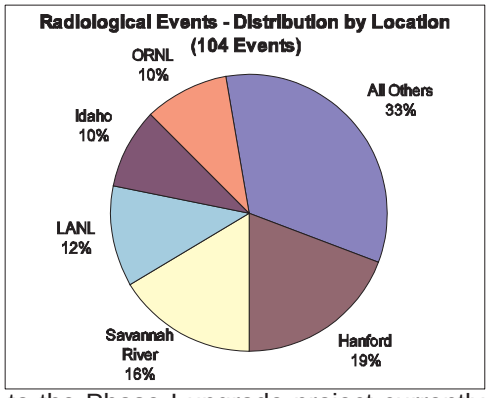
- The events reported in 96Q4 were analyzed as to the type of activity that was taking place at the time of the contamination. The following chart depicts this analysis.



- 36 of the 104 events reported the specific isotopes involved in the contamination. Of these events, 15 (47%) were attributable to either Plutonium 238 or Plutonium 239.

Distribution by Location:

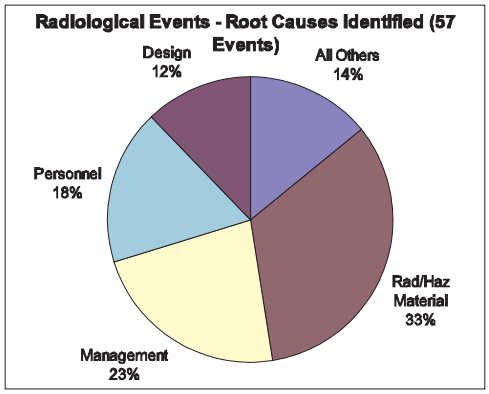
- The following chart depicts the distribution of radiological events by location.



- Oak Ridge National Laboratory (ORNL) has exhibited a significant increase in number of contamination events this quarter (10) when compared to the previous 4 quarter total (14). 7 of these 10 events in 96Q4 involved shoe contamination.
- At Los Alamos National Laboratory (LANL), 9 of the 12 contamination events took place at the Chemistry/Metallurgy Research (CMR) building. Discussion with field personnel indicates that these events are largely attributed to the Phase I upgrade project currently under way at the facility. Corrective action has been taken to minimize the potential of future contamination. Four of these 9 events at CMR involved positive nasal smears with Plutonium 238 or 239 being the contaminant.
- At Hanford, 17 of the 20 contamination events took place at 4 facilities: Plutonium Finishing Plant (5), Tank Farms (5), K Area Basins (4), and the Analytical Laboratory (3).
- At the Savannah River Site, 7 of the 17 contamination events took place in the Laboratory Technical Area. Of these 7 events, 5 involved shoe contamination.

Distribution by Root Cause:

Of the 104 radiological contamination events reported in 96Q4, 57 had performed a root cause analysis (the remainder are pending determination). The following chart depicts the root cause distribution of these 57 events.



Special Study:

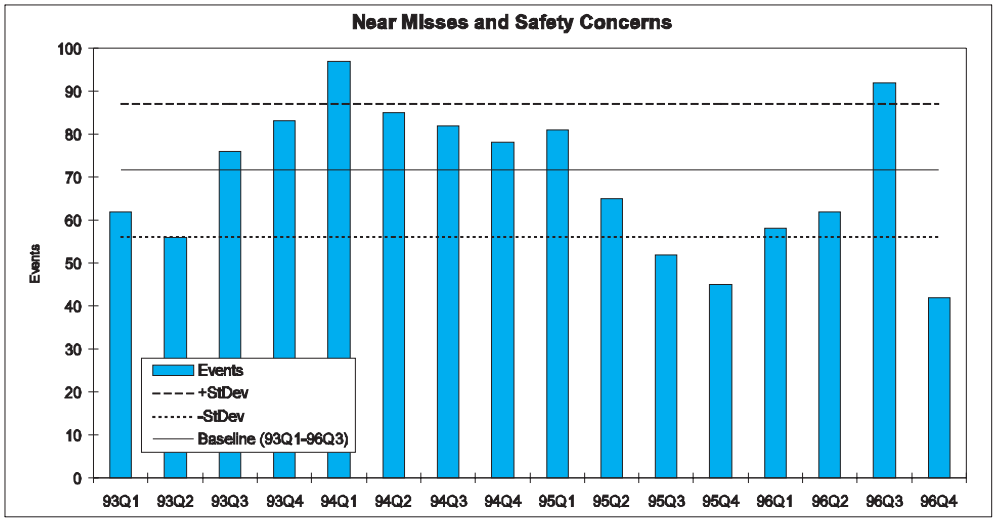
LANL recently completed a study of radiological contamination events at the site identifying the migration of contaminants through perspiration-soaked anti-contamination clothing as the leading cause of personnel contamination. This report can be accessed at the following World Wide Web address: http://lib-www.lanl.gov/la-pubs/00326196.pdf.

Indicator

13. Near Misses and Safety Concerns

Definition

A near miss is an operational event where barriers to an accident have been compromised such that no barriers or only one barrier remain. A safety concern includes: the unauthorized use of hazardous products or processes, or if work is shut down as a result of an OSHA violation. Near misses and safety concerns are reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department analysts.

Key Observations

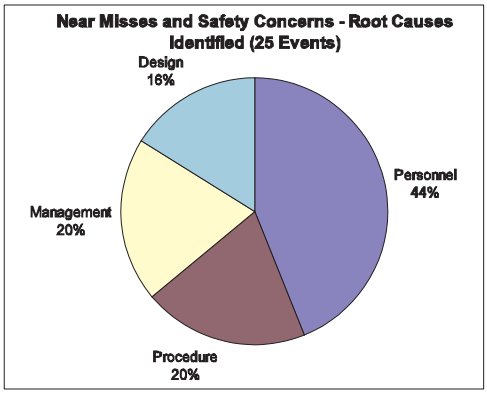
- The total number of near misses and safety concerns decreased significantly, going from 91 in 96Q3 to 42 in 96Q4.
- The number of occurrences relating to electrical safety concerns also was reduced from 34 in the last quarter to 12 in the current quarter. However, electrical events are still the most frequently reported near misses in 96Q4. In addition, among the total 7 more serious (unusual) occurrences reported in the quarter, 2 were attributed to electrical safety concerns.
- There were 3 near miss events that resulted in personal injuries in 96Q4, and all were construction related.

Additional Analysis

Distribution by Type of Activity: The major activities involved in near misses and safety concerns events reported during 96Q4 were:

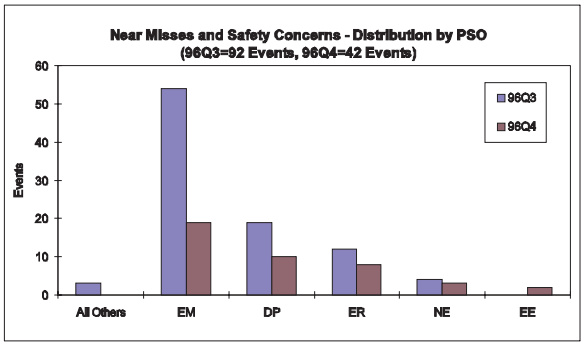
- Electrical Safety Events - 12 (29%)
- Construction Related Events - 11 (26%)
- Radiation Protection/Hazardous Material Handling Events - 5 (12%)

Distribution by Root Cause: The chart depicts the distribution of near misses by root cause for those events in which the root cause has been identified (25 of 42 events).



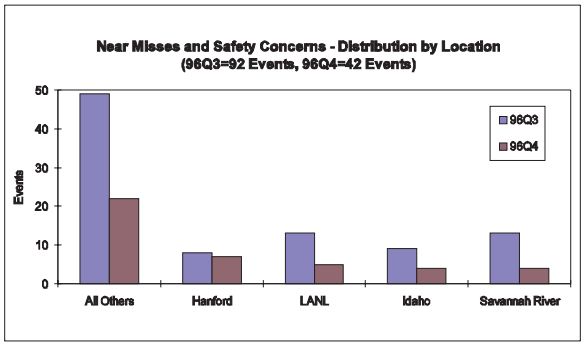
Distribution by PSO: The distribution by Program Secretarial Office (PSO) is shown in the chart.

- Among the 7 more serious (unusual) occurrences reported in 96Q4, DP contributed 4 and EM contributed 3.



Distribution by Location: Distribution by major location is shown in the chart.

- For 96Q4, Savannah River, Los Alamos, and Idaho/LITC reported significantly fewer events (4, 5, and 4 respectively) as compared with 96Q3.

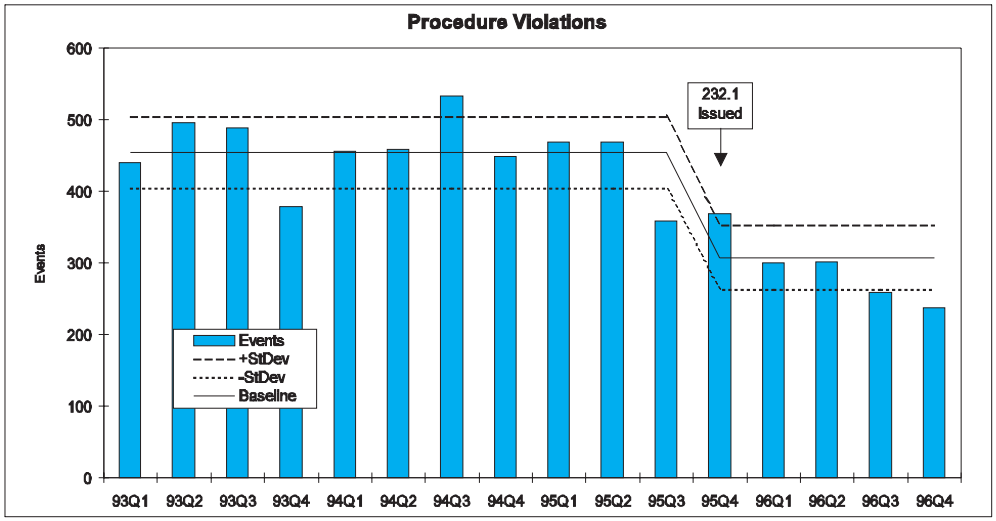


Indicator

14. Inadequate Procedures/Procedures Not Followed

Definition

Number of reportable events as defined in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, which are either categorized as procedure violations or problems, or which are reported as being caused by a procedure violation or problem.



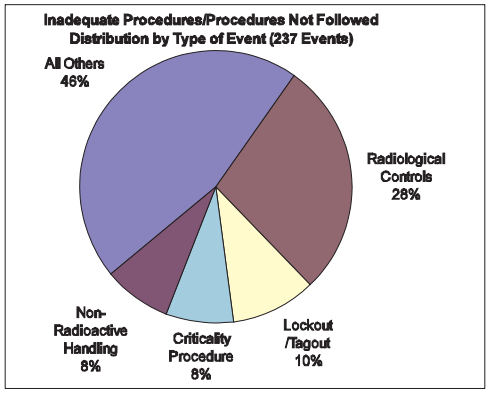
Source: Review of Occurrence Reports by Department analysts.

Key Observations

- A decreasing trend exists since 93Q1 based on MLRT analysis. This trend is especially apparent since 94Q4.
- Although the number of events for this indicator only dropped by 8% from last quarter (259 events in 96Q3 and 237 in 96Q4), there was a substantial change in the major contributing sites across the complex. Primarily, Rocky Flats contribution dropped by over 50% from 96Q3. This was most noticeably offset by a similar increase in the events reported at Hanford.

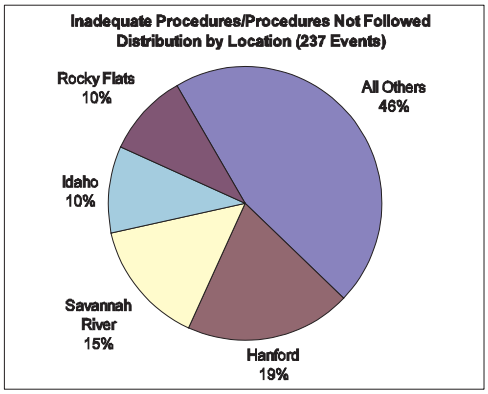
Additional Analysis

Distribution by Type of Activity: The major types of events reported during 96Q4 were:



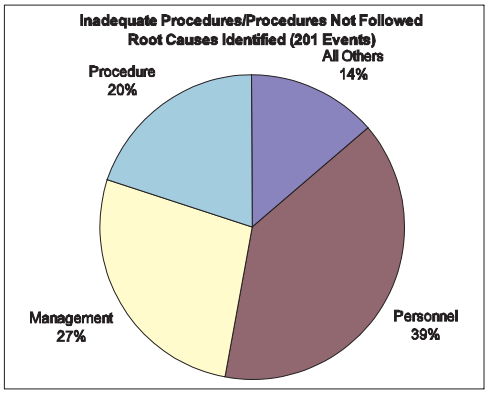
- Radiological Controls-Related Events-67 (28%)
- Lockout/Tagout-Related Events-24 (10%)
- Criticality Procedure-Related Events-18 (8%)
- Non-Radioactive Waste Handling-Related Events-18 (8%)
- Other significant contributors included electrical maintenance, industrial operations, and explosives safety events.

Distribution by Location: The following chart represents the four major contributors.



- The number of events in 96Q4 at Hanford increased significantly over the events reported in 96Q3 (from 33 events in 96Q3 to 46 events in 96Q4). This increase can be attributed to an increase in the number of ventilation and criticality monitoring system related events reported at Hanford in 96Q4.
- Rocky Flats has been among the top three contributors consistently since 93Q1 and the top contributor since 95Q4. However, the number of events at Rocky Flats dropped substantially from the 93Q3 total of 52 events to 24 events in 96Q4. This decrease can be primarily attributed to a drop in the number of radiological controls and ventilation system procedure-related problems.

Distribution by Root Cause:



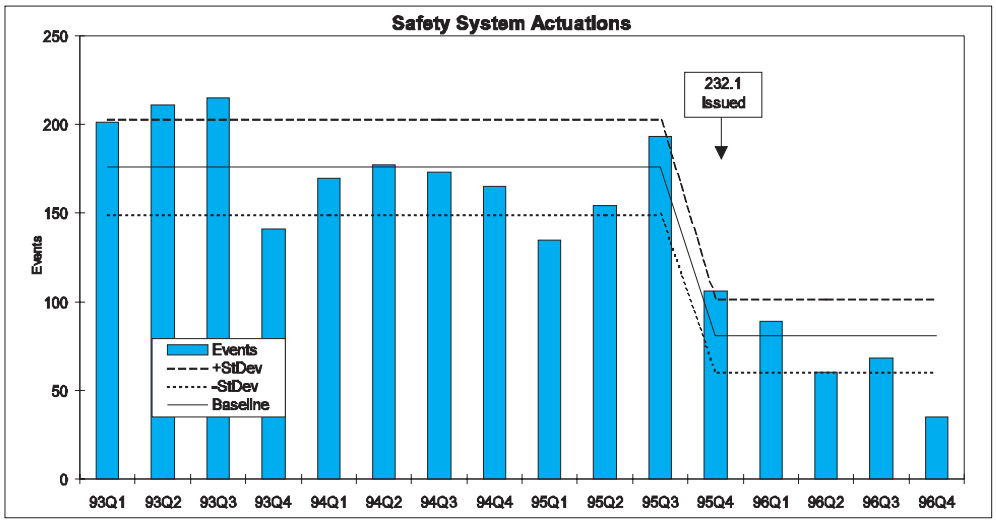
- As has been the case since 93Q1, for those events with root causes identified, the top 3 cited root cause categories were Personnel (78 events), Management (55 events), and Procedure (40 events).
  - Of the personnel errors cited, procedures not used or used incorrectly and inattention to detail were the top 2 contributors.
  - The top 3 management causes were inadequate administrative controls; policy not adequately defined, disseminated, or enforced; and work organization/planning deficiencies.
  - Defective or inadequate procedure was the top procedural root cause identified.
  - No root cause was determined for 36 events at the time that the analysis for this indicator was performed.

Indicator

15. Safety System Actuations

Definition

Safety System Actuations are operations related events, not drills or practices. These events have the potential to impact the safety and health of people in their vicinity. This includes the real actuation of any safety class equipment or alarm, unplanned electrical outages, unplanned outages of service systems, serious disruption of facility activity related to weather, facility evacuations, or loss of process ventilation, reportable under DOE Manual 232.1-1*, Occurrence Reporting and Processing of Operations Information*, in section 8, Categorization of Reportable Occurrences, para H Operations.



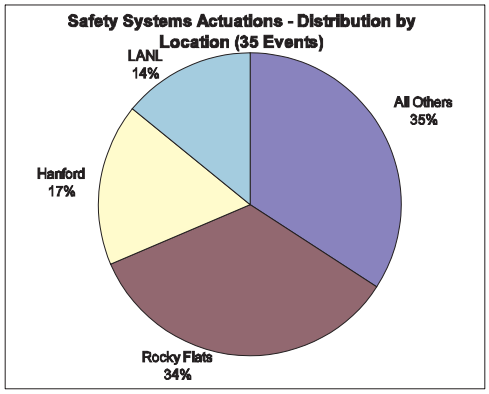
Source: Review of Occurrence Reports by Department analysts.

Key Observations

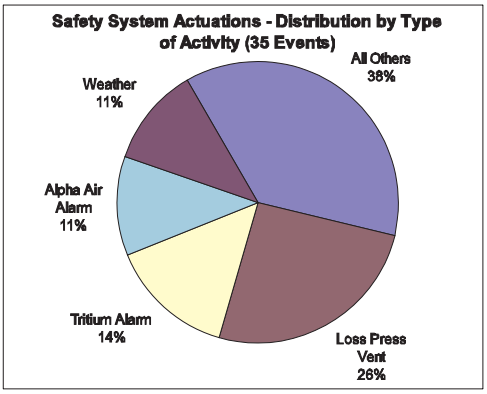
- The number of safety system actuations has continued to decline since the issuance of DOE O 232.1 in 95Q4. The number of actuations in 96Q3 (68) has decreased to 35 in 96Q4.

Additional Analysis

Distribution by Location: The chart shows the distribution of safety system actuations by location. While 30 of the reports were listed as Off-Normal occurrences, 3 were reported as Unusual, and 2 were Emergencies at the "Alert" level in which the Emergency Operations Center activated. Of the two emergency events, one involved a tritium alarm actuation at the Mound Plant, and the other involved freeze-related damage at Rocky Flats.

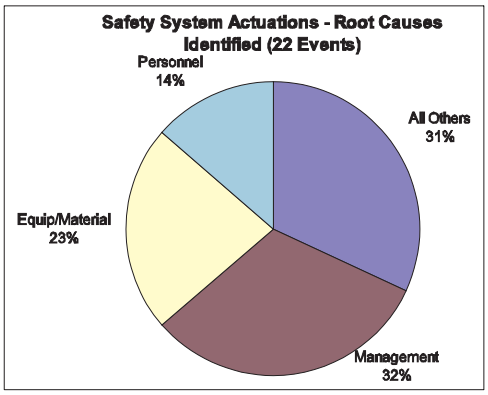


Distribution by Type of Activity: The chart shows the distribution of safety system actuations by type of activity.



- Unplanned loss of process ventilation initiated nine actuations. Four occurred in Richland, three in Los Alamos National Lab (LANL), one in Rocky Flats, and one in West Valley. Five of these involved material failure from old or worn equipment.
- There were five Tritium alarm actuations. Three of the five tritium alarm actuations occurred at the Mound Plant.
- Fire alarms were noted in 3 occurrence reports. Two of the reports involved fires at Savannah River and Rocky Flats; one fire was due to defective equipment design and the other was due to personnel error. The third fire was attributable to procedural errors.
- Alpha air monitor alarms were reported in two reports (one report had three occurrences) from Rocky Flats. These were caused by legacy contamination.

Distribution by Root Cause: The chart depicts the distribution of safety system actuations by root cause for those events in which the root cause has been identified.



- Equipment or material failure caused the largest number of actuations in this quarter; however, procedural errors by personnel are also significant.
- Legacy radiation and severe weather have caused an equal but smaller number of actuations.

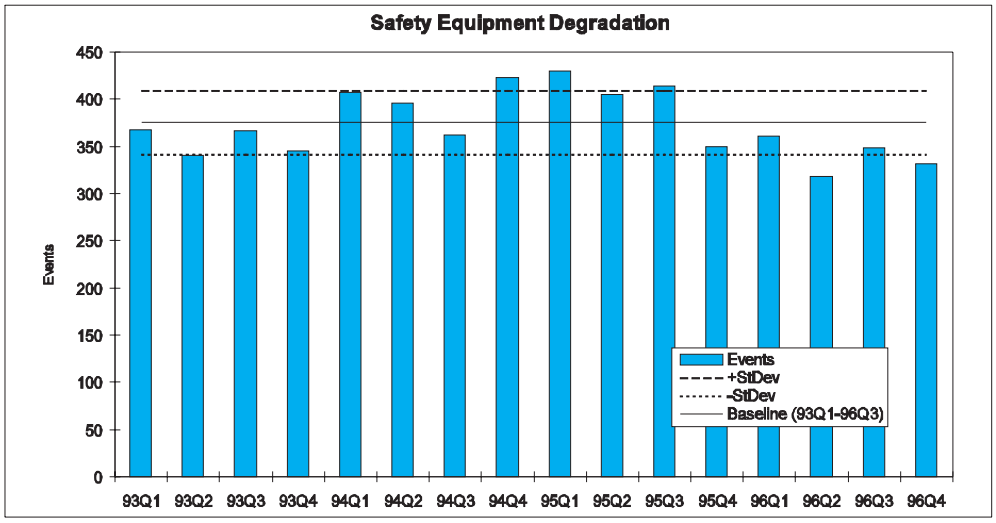
Indicator

16. Safety Equipment Degradation

Definition

Number of reportable events categorized as "vital system/component degradation" as defined in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.

Safety equipment degradation includes: (1) any unplanned occurrence that results in the safety status or the authorization basis of a facility or process being seriously degraded; or (2) a deficiency such that a structure, system, or component (SSC) vital to safety or program performance does not conform to stated criteria and cannot perform its intended function; or (3) unsatisfactory surveillance/inspections and appraisal findings of any safety class SSC.



Source: Review of Occurrence Reports by Department analysts.

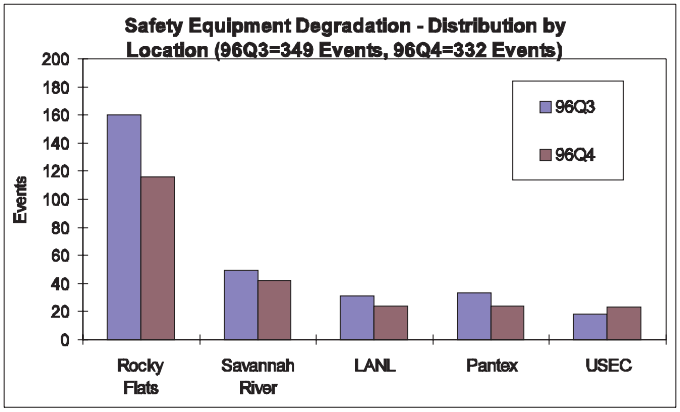
Key Observations

- A decreasing trend in safety equipment degradation events has been observed since 94Q1.

Additional Analysis

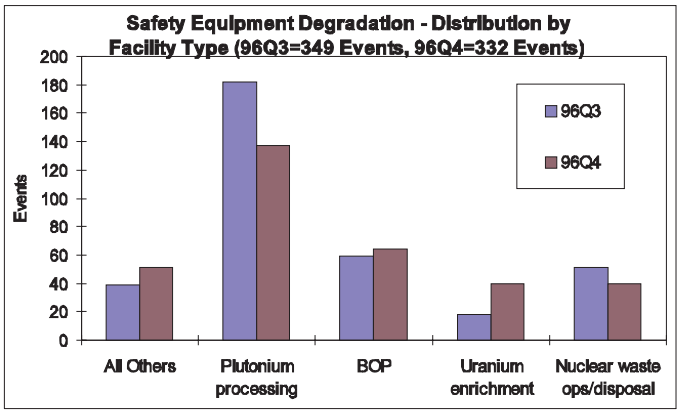
Distribution by Location:

- Distributions for the major contributors of safety equipment degradation events for 96Q3 and 96Q4 are shown in the graph. The biggest contributor in both quarters was Rocky Flats.
- For 96Q4, approximately 30% of all safety equipment degradation events at Rocky Flats were related to defective/degraded pressure differential controllers and ventilation systems.



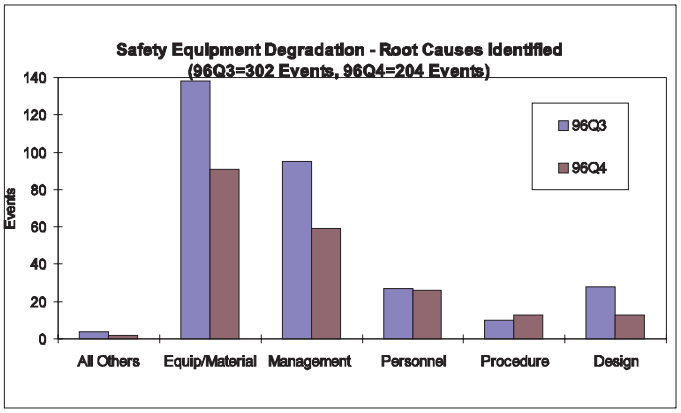
- Rocky Flats, Pantex, and Los Alamos National Laboratory (LANL) each exhibited a decrease of approximately 25% in the number of degradation events for the 96Q4 reporting period, while US Enrichment Corporation (USEC) experienced an increase of approximately 25%.

Distribution by Facility Type:



- Distributions of safety equipment degradation events by facility type for 96Q3 and 96Q4 are shown in the graph. Historically, plutonium processing facilities have been the largest contributor to safety equipment degradation events, averaging approximately 36% of the total events since 93Q1.
- Events related to plutonium processing operations and nuclear waste operations/disposal decreased by approximately 23% each, while events related to uranium processing operations increased by approximately 100%.

Distribution by Root Cause: The graph shows distributions of major root causes of safety degradation events identified for 96Q3 and 96Q4. Historically, the largest root cause category has been equipment/material problems, with the sub-category defective or failed parts averaging 88% of equipment/material problems since 93Q1.

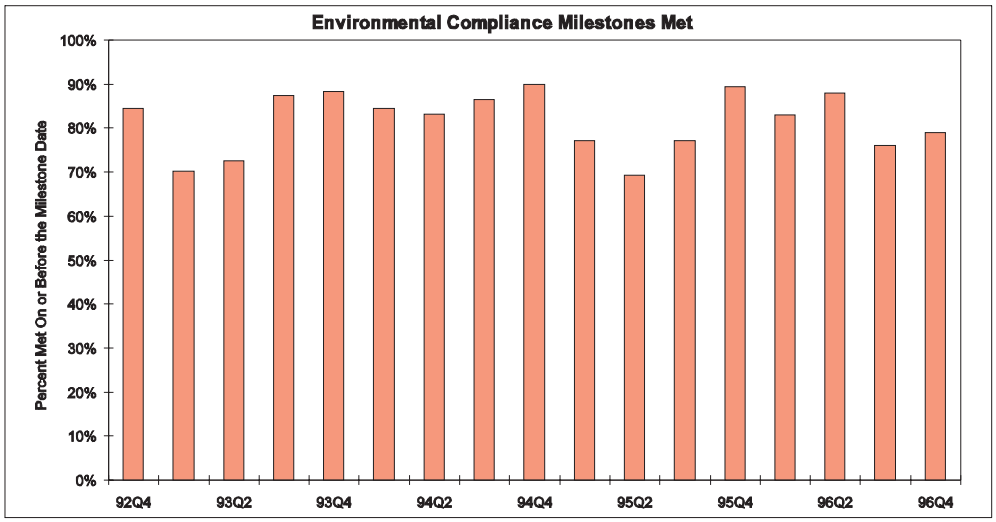


Indicator

17. Environmental Compliance Milestones Met

Definition

Enforceable requirements in environmental agreements, met on or before the milestone date (percent).



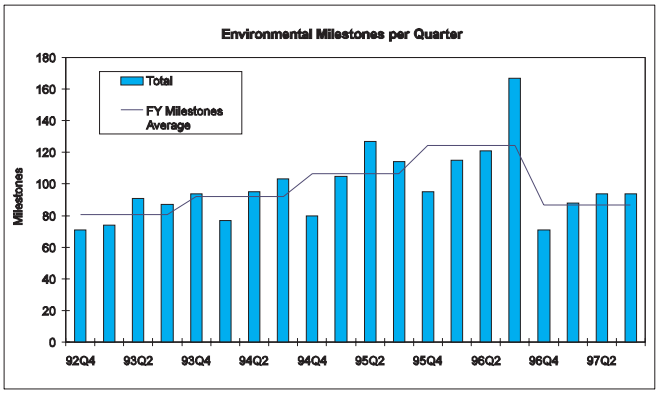
Source: Progress Tracking System Data, Office of Environmental Management.

Key Observations

- In the most recent quarter, DOE met 79% of its enforceable compliance milestones. Over the previous four quarters (fiscal year 1996) DOE met 83% of its milestones.

Additional Analysis

- There are currently 347 milestones identified for fiscal year 1997. This compares with 498 in FY 1996 and 323 in FY 1993.



- These data do not capture all enforceable milestones; they reflect those milestones under the purview of the Office of Environmental Management. EM's Progress Tracking System is believed to capture 85–90% of all DOE enforceable environmental milestones.

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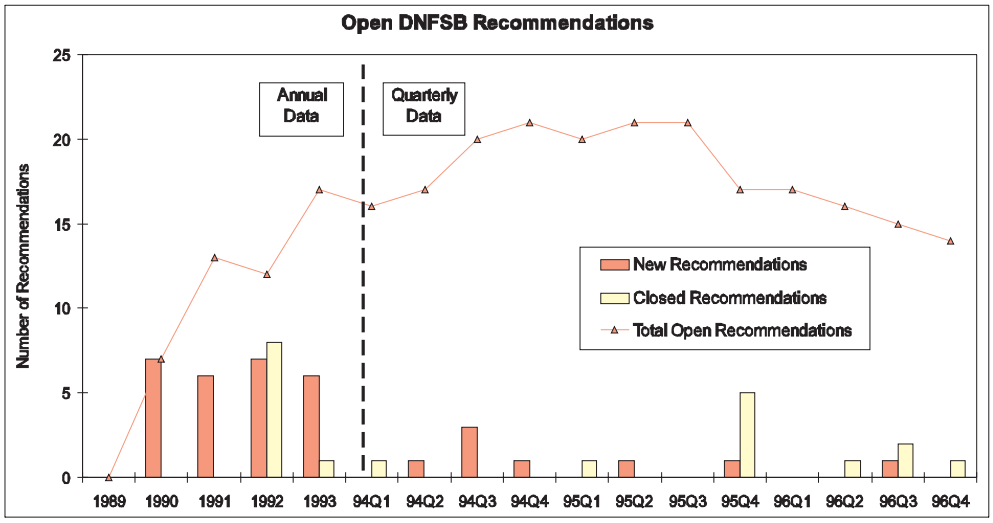
Indicator

18. Open DNFSB Recommendations

Definition

The cumulative number of open Defense Nuclear Facilities Safety Board (DNFSB) recommendations. DNFSB recommendations only apply to DOE defense nuclear facilities and, therefore, are representative only of DOE defense facilities involved in nuclear safety issues.

Each DNFSB recommendation accepted by DOE leads to an implementation plan containing a set of commitments which, when fully implemented, will resolve the safety issues and lead to closure of the recommendation. A commitment is any documented obligation by the Secretary, or designee, that describes products to be delivered on a specified schedule. Commitments resulting from DNFSB recommendations are tracked by the Office of the Departmental Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.



Source: Safety Issues Management System.

Key Observations

- After December 1996, there were 14 open DNFSB recommendations representing 893 DOE commitments. 62% of the commitments were considered to be satisfied or fulfilled. One recommendation (91-6, Radiation Protection) was closed during 96Q4, while no new recommendations were added.
- The Department issued one implementation plan: 96-1 (In-Tank Precipitation System) which added 25 new commitments total (7 of which have already been completed).

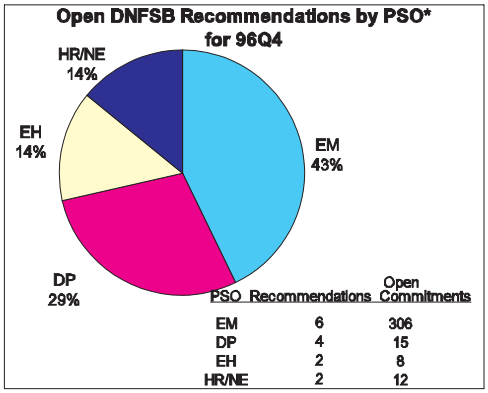
Additional Analysis

- Environmental Management (EM) and Defense Programs (DP) continue to be responsible for implementing most of the recommendations. The cumulative subtotals through 96Q3 are represented in the table on the following page.

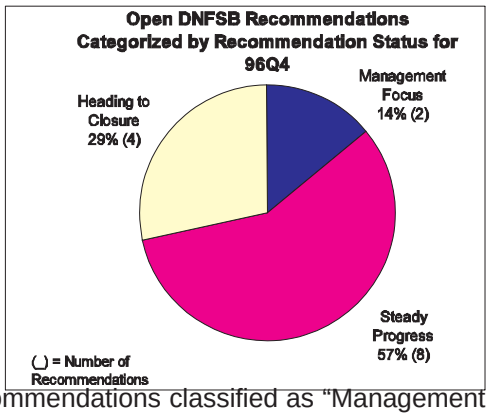
Office	DNFSB Recommendations	Commitments	Fulfilled	Not Yet Due	Overdue
EM	6	677	371 (55%)	197 (29%)	109 (16%)
DP	4	105	90 (86%)	12 (11%)	3 (3%)
EH	2	21	13 (62%)	2 (10%)	6 (29%)
HR/NE	2	90	78 (87%)	7 (8%)	5 (6%)
Total	14	893	552 (62%)	218 (24%)	123 (14%)

Distribution of Open Commitments

- There continues to be an improving trend in the number of open commitments (the sum of overdue commitments and not yet due commitments based on a projected schedule of completion incorporated within the implementation plans). There were 436 open commitments as of the end of June 1996. At the end of September 1996, there were only 391 open commitments and December 1996 ended with only 341 open commitments. As a subset of open commitments, overdue commitments increased slightly in number over September 1996. There were 135 overdue commitments (12% of total) after June 1996, 113 (12% of total) after September 1996, and 123 (14% of total) after December 1996.
- EM facilities account for 43% of the open recommendations for 96Q4; however, EM facilities account for 90% of the open commitments.
- 2 of the 14 open recommendations are more than 90% complete.



Characterization of Recommendation Status: The graph shows an evaluation by S-3.1 on the number of open DNFSB recommendations categorized by recommendation status. A status of "Heading to Closure" includes the existence of a clearly defined path to closure, and the expectation that the remaining commitments/actions can be completed within the next year. "Steady Progress" implies the existence of an acceptable implementation plan with most commitments/deliverables generally being completed on schedule. Recommendations classified as "Management Focus" involve difficulties with (or lack of) an implementation plan or a large number (10) of overdue commitments. 2 recommendations were upgraded and removed from the Management Focus category during 96Q4. These included Recommendation 96-1 (In-Tank Precipitation System), for which the Department implementation plan was established in November 1996; and Recommendation 93-3 (Improving Technical Capability), for which the number of overdue commitments has been reduced.



Indicator

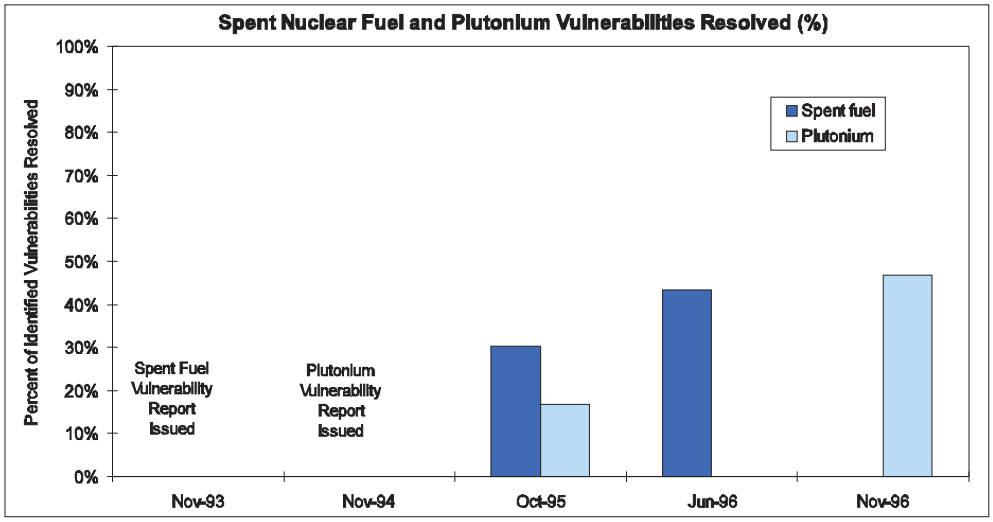
19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

Definition

The number of resolved plutonium and spent fuel vulnerabilities divided by the total number of vulnerabilities as defined in *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel...and Their Environmental, Safety, and Health Vulnerabilities,* Volume 1, November 1993, and *Plutonium Working Group Report on Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1994 (DOE/EH-0415).

An ES&H vulnerability is defined in the plutonium and spent fuel vulnerability reports as "conditions or weaknesses that could lead to unnecessary or increased radiation exposure of workers, release of radioactive material to the environment or radiation exposure of the public." A resolved vulnerability implies that the cited condition no longer exists, the risk has been minimized to an acceptable level, or the risk has been evaluated at an active facility and judged to be acceptable. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weaknesses), or institutional vulnerabilities (e.g., loss of experienced personnel). The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.

No new data were available for this report.



Source: Draft Plutonium Vulnerability Management Summary Report, November, 1996 (EM-66),
Report on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, June, 1996 (EM-67).

Key Observations

- There were 299 plutonium vulnerabilities identified at 13 sites and 106 spent nuclear fuel vulnerabilities identified at 8 sites based on reports issued in 1993 and 1994.
- As of 96Q3, 47% of the identified plutonium vulnerabilities have been resolved.
- As of 96Q2, 43% of the identified spent fuel vulnerabilities have been resolved.

Additional Analysis

- The most spent nuclear fuel vulnerabilities were identified at Hanford, which maintains 80% of the DOE total spent nuclear fuel inventory by weight.

- The following table indicates the breakdown of spent nuclear fuel vulnerabilities as of 96Q2 by location and the progress of resolving the identified vulnerabilities.

Spent Nuclear Fuel Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Hanford	36	18	50%
Idaho	33	6	18%
Savannah River	21	13	62%
All Others	16	9	56%
Total	106	46	43%

- The most plutonium vulnerabilities were identified at Rocky Flats, which maintains 80% of the DOE total plutonium inventory by weight. Of these 87 vulnerabilities, 16 have been closed and an additional 18 have had the risk reduced to an acceptable level.
- Los Alamos had similar success pursuing plutonium vulnerabilities with 14 issues closed and the risk in 22 other issues reduced to an acceptable level.
- The following table indicates the breakdown of plutonium vulnerabilities as of 96Q3 by location and the progress of resolving the identified vulnerabilities.

Plutonium Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Rocky Flats	87	34	39%
Los Alamos	60	36	60%
Savannah River	40	13	33%
Hanford	34	9	26%
All Others	78	48	62%
Total	299	140	47%

- 16 of the top 46 highest risk plutonium vulnerabilities, DOE-wide, have been resolved. 10 were completed; the risk for 6 other issues has been reduced or judged acceptable.

Indicator

20. Plutonium Stabilization

Definition

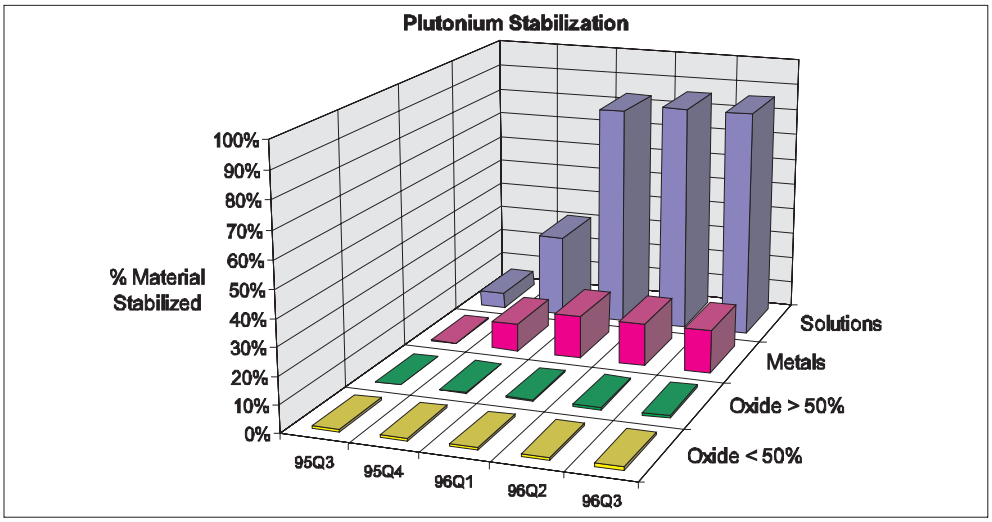
Progress in plutonium (Pu) stabilization as outlined in the DOE implementation plan response to DNFSB Recommendation 94-1. The performance measure is depicted in cumulative percentages of the total inventory (in stabilization units; SU) of plutonium solutions, metals, and oxides that are stabilized.

1 Pu solution SU = 4000 liters

1 metal SU = 90 kg

1 oxide SU = 60 kg

No new data were available for this report.



Source: Nuclear Materials Stabilization Task Group Quarterly Report, June 1 - August 31, 1996,
BNL Data Base on Plutonium Stabilization, September, 1996.

Key Observations

- DOE-wide, the milestones for stabilization of the various Pu forms for 1996 have been met by 96Q3. The progress in stabilization of Pu metal has far exceeded the goal set by the implementation plan.

Additional Analysis

Distribution by Location

- Savannah River initially accounted for 86% of the Pu solution inventory requiring stabilization, and 90% of the Savannah River inventory has been stabilized.
- Plutonium stabilization of corroding plutonium targets was completed six weeks earlier than scheduled at Savannah River.
- Rocky Flats initially accounted for 40% of the metals inventory requiring stabilization, and 29% of the Rocky Flats inventory has been stabilized. Savannah River initially accounted for 49% of the metals inventory requiring stabilization and 8% of the Savannah River inventory has been stabilized.
- Rocky Flats initially accounted for 58% of the Pu oxides (>50% assay) inventory requiring stabilization, and 51% of the Pu oxides (<50% assay) inventory requiring stabilization.

Future Planning

- Richland will decelerate stabilization of polycubes (polystyrene cubes impregnated with plutonium oxide that generate gases rapidly and are difficult to store safely) and allow resources to be focused on higher priority solution stabilization and packaging. It is still expected that polycube stabilization will be completed on schedule (January 2001).
- A prototype Pu stabilization and packaging unit is expected to be installed at Rocky Flats during 1997. The design was approved during 96Q3. This equipment, including the storage container, is expected to become the DOE standard for long-term storage of Pu.

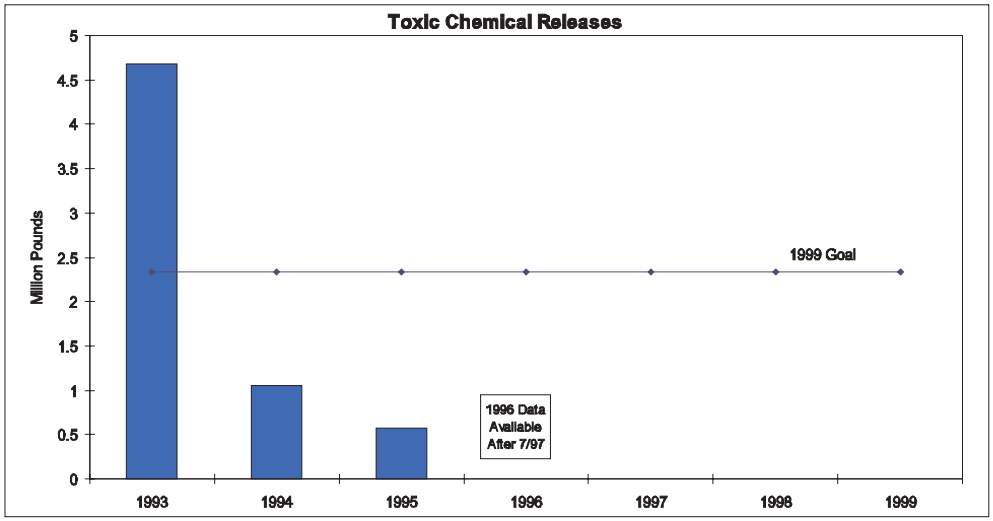
Indicator

21. Toxic Chemical Releases

Definition

Toxic Release Inventory (TRI) chemicals released or transferred off-site for treatment and/or disposal (pounds).

No new data were available for this report.



Source: Individual site Section 313 Form R reports. 1995 data not yet validated by sites.

Key Observations

- Executive Order 12856[a] requires Federal agencies to reduce their toxic chemical releases and off-site transfers by 50% before December 31, 1999, using a pre-established baseline year of 1993. DOE's reported releases continue to decrease, from 4,678,000 pounds in 1993, to 1,048,500 pounds in 1994, and to 577,000 pounds in 1995.

Additional Analysis

Reporting Requirements and Goals

- Executive Order 12856 directed all Federal agencies to reduce releases and off-site transfers of toxic chemicals by 50% before December 31, 1999 [as reported in the Emergency Planning and Community Right-to-Know Act's Toxic Chemical Release Inventory (TRI)] .
- DOE's 1993 baseline total is 4,678,000 pounds. This is 0.1% of the 1993 industry-wide total.

DOE TRI

- The number of DOE sites reporting under TRI has decreased from 23 in 1993 to 22 in 1994 and 17 in 1995.
- The number of Form R's submitted has changed from 89 in 1993 to 91 in 1994 to 54 in 1995.
- The number of chemicals reported by DOE under TRI has changed from 28 in 1993 and 1994 to 21 in 1995.
- The amount of toxic chemicals transferred off-site for treatment and/or disposal has changed from 35,210 pounds in 1993 to 57,141 pounds in 1994 to 6,250 pounds in 1995.

- Methanol accounted for 79% (3,666,000 pounds) of DOE's total TRI in 1993. Naval Petroleum Reserve #1 (NPR#1) reported 81% (3,783,000 pounds) of the DOE TRI baseline, of which 3,614,000 pounds were methanol. In 1994, reported methanol releases at NPR#1 were reduced by more than 90% below releases reported for 1993 (to 313,000 pounds) by improving estimates based on sampling and monitoring.
- Portsmouth Gaseous Diffusion Plant also reported a major decrease (from 172,000 pounds in 1993 to 2,781 pounds in 1994). The decrease is entirely due to approximately 170,000 pounds of dichlorotetrafluoroethane (Freon 114) reported in 1993 (and none in 1994). The decrease in the amount Portsmouth reported to DOE is due to the transfer of Portsmouth operations to the U.S. Enrichment Corporation in mid-1993; USEC is now responsible for reporting.

Reference

[a] Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, signed August 2,1993.

Indicator

22. Pollution Prevention

Definition

In May 1996, the Department set the following goals to be achieved by December 31, 1999, using calendar year 1993 as a baseline year.[a]

- Reduce by 50% the generation of radioactive waste (for routine operations).
- Reduce by 50% the generation of low-level mixed waste (for routine operations).
- Reduce by 50% the generation of hazardous waste (for routine operations).
- Reduce by 33% the generation of sanitary waste (for routine operations).
- Reduce by 50% total releases and off-site transfers for treatment and disposal of toxic chemicals (for routine operations).
- Recycle 33% of sanitary waste (for all operations, including cleanup/stabilization activities).
- Increase procurement of Environmental Protection Agency-designated recycled products to 100%, except where they are not commercially available competitively at a reasonable price or do not meet performance standards.

Key Observations

- Current data are provided in this report for Toxic Chemical Releases. Work is ongoing to evaluate possible measures for these goals.

Reference

[a] Memorandum "Departmental Pollution Prevention Goals" Hazel O'Leary to Heads of Departmental Elements, May 3, 1996, reprinted in *Pollution Prevention Program Plan 1996*, DOE/S-0118

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Indicator

23. HEU Vulnerabilities Resolved

Definition

The percentage of vulnerabilities identified in the *Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium* (DOE/EH-0525) that have been resolved.

Key Observations

This indicator will be used to measure the progress in resolving the total of 155 ES&H vulnerabilities found in the assessment, and also specific subsets of these vulnerabilities: 1) the facility and material condition vulnerabilities ranked by the HEU Working Group as being of highest significance, 2) vulnerabilities at specific sites, and 3) vulnerabilities involving U-233.

A significant fraction of the HEU's Working Group assessment involved U-233, stemming from this isotope's particular radiological properties (and those of U-232 co-produced with U-233). The HEU Working Group concluded that a special management plan is needed for safe interim storage of U-233 materials. Thus, U-233 vulnerabilities will be tracked as a separate group, even thought this will involve "double counting" of some vulnerabilities ranked as having the highest significance.

An ES&H vulnerability is defined in the HEU Working Group Report as "conditions or weaknesses that could result in the exposure of workers or the public to radiation, or in releases of radioactive materials to the environment." Led by the Office of Defense Programs (DP), DOE has developed the *HEU Vulnerability Management Plan* (currently in draft) that outlines a process for corrective actions and resolution of the HEU vulnerabilities. DP will track the resolution of the HEU vulnerabilities and report these either by a separate quarterly status report, or by information included in status reports that combine HEU vulnerability resolution with those for plutonium and/or spent fuel vulnerabilities.

The following table summarizes the Department-wide status of HEU vulnerability resolution:

HEU Vulnerability Set	Vulnerabilities Identified	Vulnerabilities Resolved	P.I. = % Resolved
Total, DOE-Wide	155		
Highest Significance	21		
U-233 Vulnerabilities	13		

Additional Analysis

The following table summarizes vulnerabilities on a site basis. Note that the Oak Ridge Y-12 Plant stores a far greater amount of HEU (greater than 189 metric tons) than any other site. Note also that ORNL and INEEL have the largest quantities of U-233 (424 and 40 kilograms, respectively).

HEU Site	Vulnerabilities Identified	Vulnerabilities Resolved	P.I. = Resolved
Oak Ridge Y-12 Plant	49		
Rocky Flats Env. Tech. Site	28		
Los Alamos National Lab	19		
Portsmouth Gaseous Dif. Plant	16		
Idaho Nat. Engineering & Environmental Lab	10		
Savannah River Site	9		
Oak Ridge K-25 Site	9		
Oak Ridge National Lab	6		
Pantex Plant,	5		
Sandia National Laboratories	1		
Argonne National Lab-West	1		
Lawrence Livermore Nat. Lab	1		
New Brunswick Laboratory	1		

As of this report, the HEU Vulnerability Management Plan was still in draft. When finalized, this plan will set dates for resolution of the 21 HEU vulnerabilities designate by the HEU Working Group as being of highest significance. Thus tracking of the PIs for these 21 vulnerabilities can be shown against scheduled completion dates, after the Management Plan is issued.

The resolution of the other 134 HEU vulnerabilities identified in the HEU Vulnerability Assessment will depend on site-specific plans. Many of the plans may become part of existing plans for DNFSB 94-1. Because of the need to work with separate field offices, scheduling and tracking of PIs concerning the other 134 vulnerabilities will take more effort and time to perform than those explicitly covered in the HEU Management Plan.

On March 3, 1997, the DNFSB issued Recommendation 97-1 which concerns the safety of U-233. Many of the Board's recommendations reflect findings and conclusions made in the HEU Vulnerability Assessment. DOE owes an Implementation Plan for Recommendation 97-1 by April 11, 1997, unless an extension is granted. This response could significantly change the current draft HEU Management Plan. Scheduling and tracking of the PI associated with U-233 vulnerabilities may thus need to wait until DOE develops a plan for DNFSB 97-1.

The Secretary's Commitments to the President in ES&H and EQ

Environment, Safety and Health (ES&H) and Environmental Quality (EQ) commitments as part of the Secretary of Energy's Performance Agreement with the President for Fiscal Year 1997 are currently under development. This section will include a summary of these commitments and their status in future ES&H Performance Indicator Reports.

More information related to the status of these commitments can be obtained from DOE's Office of Policy or via the World Wide Web at
http://www.doe.gov/policy/library/secagree.html

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Relationship to DOE Strategic Plan Goals

DOE STRATEGIC PLAN (April 1994)	PERFORMANCE INDICATORS
Eliminate Hazards and Releases **Environment, Safety, & Health Goal 1** *Empower workers and take other necessary actions to prevent all serious injuries and all fatalities, and to eliminate all worker exposures and environmental releases in excess of established limits. By eliminating these exposures and releases, reduce the incidence of illness among workers and the public, and prevent damage to the environment.*	1–2. OSH (Lost Workday Case Rate, Cost Index) 3. Electrical Safety 4. Industrial Operations Safety 5. Transportation Safety 7. Reportable Occurrences of Releases to the Environment 9. Environment Permit Exceedances 10. Radiation Dose to the Public 11. Worker Radiation Dose 12. Radiological Events 13. Near Misses and Safety Concerns 14. Inadequate Procedures/Procedures Not Followed 15. Safety System Actuations
Performance Requirements **Environment, Safety, & Health Goal 2** *Ensure there are specific environmental, safety, and health performance requirements for DOE activities which are the basis for measuring progress toward continuous improvement.*	1–2. OSH (Lost Workday Case Rate, Cost Index) 11. Worker Radiation Dose 12. Radiological Events 21. Toxic Chemical Releases
Establish Priorities **Environment, Safety, & Health Goal 3** *Establish clear environmental, safety, and health priorities and manage all activities in proactive ways that effectively and significantly increase protection to the environment and to public and worker safety and health.*	19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved 20. Plutonium Stabilization 23. HEU Vulnerabilities
Demonstrate Performance **Environment, Safety, & Health Goal 4** *Demonstrate respectable performance related to environmental protection and worker/public safety and health.*	All

(Numbers refer to corresponding Sections in this report.)

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Summary of Process

B1. Overview

One of the critical success factors identified in the Department of Energy (DOE) Strategic Plan for environment, safety and health is "ensuring the safety and health of workers and the public and the protection and restoration of the environment." This report describes a new approach for measuring the performance of DOE operations in these areas and thereby supporting management decisions aimed at "ensuring the safety." The general concept is to focus on key factors with the most impact on worker and facility safety and the environment.

Data collection was limited to available data (e.g., ORPS, CAIRS, Site Environmental Reports). The process was non-intrusive and did not expend site resources. As such, the performance indicator components may not sufficiently measure all facets of environment, safety and health. Experience from this report, along with customer feedback from the attached survey form, will be evaluated. Subsequent reports may evolve to include incorporating the components into an index to represent the combined effect that the activities have on the envelope of safety that protects the worker and the environment as experience is gained and data sources improve.

This report was reviewed by a multi-disciplinary team with expertise in nuclear and facility safety, environment, worker safety and health, health studies, and planning/administration. The team is identified in table at the end of this appendix.

B1.1 Initial Performance Measures

The performance measures included in this report are identified in the following table. Selection of the indicators involved both evaluation of the overall safety significance as well as tests of availability. A process was established where all potential indicators were evaluated with respect to significance to the ultimate goal of measuring performance in environment, safety and health. With respect to availability, a decision was made to select indicators from existing data streams to avoid, for now, levying a burden on field activities for additional data. Primarily, indicators are derived from data within four data systems and one annual report:

- *Occurrence Reporting and Processing System (ORPS)* - a system originally designed for notification of nuclear as well as non-nuclear occurrences in the field. For all indicators based on occurrence reports, data prior to 93Q1 has been removed from the graphs and analysis.
- *Computerized Accident/Incident Reporting System (CAIRS)* - a system for collecting data associated with occupational injury and illness events and statistics.
- *Radiation Exposure Monitoring System (REMS)* - a system for collecting data on individual radiation doses received by DOE complex workers.
- *Environmental Compliance Database* - a system maintained by the Office of Environmental Policy and Assistance.
- *Annual Site Environmental Reports.*

There are, of course, limitations resulting from using the data for other than the purpose for which it was collected. Further, the availability of data should not be confused with relevance to measuring performance. Indicators should be selected based on their impact on the operations being examined, not solely because the data exist. Although some of the selected indicators may be of interest to other audiences, it is likely that other valid indicators exist that should be analyzed and trended to provide the appropriate perspective (e.g., facility, contractor, program management) on performance.

PI Component	Data Source
I. Accidents/Events	
1 Lost Workday Case Rate	Computerized Accident/Incident Reporting System, EH-51
2 Occupational Safety and Health Cost Index	Computerized Accident/Incident Reporting System, EH-51
3 Electrical Safety	Review of Occurrence Reports, EH-33 Defense Programs Review of Occurrence Reports
4 Industrial Operations Safety	Review of Occurrence Reports, EH-33 Defense Programs Review of Occurrence Reports
5 Transportation Safety	Review of Occurrence Reports, EH-33 Defense Programs Review of Occurrence Reports
6 Chemical Hazard Events	Quarterly Review of Chemical Safety Concerns/Occurrence Reporting and Processing System, EH-52/EH-53/BNL
7 Reportable Occurrences of Releases to the Environment	Review of Occurrence Reports, EH-33
8 Cited Environmental Violations/Fines	Environmental Compliance Tracking Database, EH-41
9 Environmental Permit Exceedances	Annual Site Environmental Reports, EH-41
10 Radiation Dose to the Public	Annual Reports to Environmental Protection Agency (EPA) by Each Site, EH-41
11 Worker Radiation Dose	Radiation Exposure Monitoring System (REMS), EH-52
12 Radiological Events	Review of Occurrence Reports, EH-33
II. Precursors	
13 Near Misses & Safety Concerns	Review of Occurrence Reports, EH-33
14 Inadequate Procedures/ Procedures Not Followed	Review of Occurrence Reports, EH-33
15 Safety System Actuations	Review of Occurrence Reports, EH-33
16 Safety Equipment Degradation	Review of Occurrence Reports, EH-33
III. ES&H Management	
17 Environmental Compliance Milestones Met	EM Progress Tracking System (PTS), EH-41
18 Open DNFSB Recommendations	Safety Issues Management System (SIMS), S-3.1
IV. Hazards	
19 Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved	Plutonium Vulnerability Management Summary Report, EM-60; Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, EM-37
20 Plutonium Stabilization	Nuclear Materials Stabilization Task Group Quarterly Report, Data tracked by Brookhaven National Laboratory, EH-60
21 Toxic Chemical Releases	Annual DOE 3350 Pollution Prevention Report to EPA
22 Pollution Prevention	TBD - Under Development, EH-41
23. HEU Vulnerabilities	Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium, EH-32

B2. Data Analysis

B2.1 Analyses Performed

The data analysis results are summarized in the DOE Performance Indicator Report. They are intended to identify areas which should be further investigated (to identify areas that may require intervention as well as good practices to share across DOE); they do not provide absolute answers in themselves. Data analyses include:

- looking for statistically significant trends over time,
- comparison to historical averages or benchmarks (e.g., Bureau of Labor Statistics for similar industries),
- normalization of events to opportunities (e.g., construction related events divided by construction hours worked or construction dollars spent),
- examination for statistically significant trends in types of operations, severity or type of events, and causes.

Typically, the historical baseline is established using existing data excluding the most recent quarter. The two most recent quarters are excluded for data originating from CAIRS to account for the time lag in data reporting.

Where possible, data were analyzed by quarter. In some cases, data were also viewed monthly to reveal any interesting seasonal effects not evident in the quarterly data grouping. Where appropriate, sites were contacted to provide perspective for unusual data values or trends. Data sources for several of these measures are annual; the need for more frequent data must be evaluated for future reports.

The data can also be used to perform other special analyses and reports (such as trends in causes and types of events). These analyses and reports could support special needs, such as oversight preparation and programmatic reviews.

The same approach can be used to perform more detailed functional or programmatic analyses by identifying subsets (peer groups) of DOE facilities for further examination. Examples of peer groups might include: reactors, accelerators, major clean-up sites, waste storage areas, defense chemical facilities, fossil energy sites, laboratories and spent fuel storage facilities.

B2.2 Determining Statistical Significance of Trends

The Multinomial Likelihood Ratio Test (MLRT) is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events.

MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trends. Consider the following question: “If the data are generated by a constant trend multinomial model, what is the probability of observing

a smaller ratio than that computed from the observed sequence?" This probability is called the significance level of the test and is interpreted as follows:

Significance Level	Conclusion
> 0.1 to 1.0	no departures from constant trend detected
> 0.05 to 0.1	possible increasing (or decreasing) trend
> 0.01 to 0.05	probable increasing (or decreasing) trend
> 0.001 to 0.01	very probable increasing (or decreasing) trend
0 to 0.001	highly probable increasing (or decreasing) trend

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

B3. Future Plans

This report is considered a "work in progress". Since the last report, 1 indicator has been added. Future activities are focused on obtaining feedback on the approach and improving the effectiveness of the product, including:

- Developing, in partnership with the field organizations, performance indicators that provide a measure of how well DOE is doing in (a) reducing hazards or vulnerabilities and (b) safety management including training, management involvement, and worker involvement. These new measures, combined with measures currently available, will more ably answer the critical questions of "what is DOE's actual and potential impact on people and the environment" and "is DOE getting safer."
- Providing more normalized or risk-based data that lends itself better to analysis and comparison.
- Establishment of Corporate goals for most indicators and comparison to average and best-in-class companies.
- Internet web-based tools to provide up-to-date data and charts of most performance indicators.

Future reports will be refined as data are gathered and customer input is received. Over time, new knowledge and changing missions will be reflected in the process.

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Glossary

Baselines

Baselines provide an historical reference point used to show how the current period compares to past experience. Generally, historical baselines are established using existing data excluding the most recent reporting period. For the data which originates from CAIRS, the two most recent quarters are excluded to account for the lag in data reporting. Baselines established for data originating from occurrence reports are reevaluated each time the governing reporting order changes. In addition, the graphs show the historical baseline ±1 standard deviation to give the reader a feel for the variation associated with the data. For Performance Indicators where there are insufficient data to calculate a meaningful baseline, no baseline is shown on the graph.

Multinomial Likelihood Ratio Test (MLRT)

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> 0.001 to 0.01	very probable increasing (or decreasing) trend
0 to 0.001	highly probable increasing (or decreasing) trend

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

Total Effective Dose Equivalent (TEDE)

TEDE = External Dose Contribution + Internal Dose Contribution. Prior to 1993, the method for calculating the internal dose contribution changed from an annual internal dose to a dose committed over 50 years. Although one may expect this change would result in higher reported doses, the elimination of the "legacy" doses from previous years' exposures resulted in lower reported doses.

The following terms are related to occurrence reporting, as required by DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.

Occurrence Categories (types of occurrences)

Occurrence categories are arranged into 10 generic groups related to DOE operations and include the following:

- 1. Facility Condition
- 2. Environmental

- 3. Personnel Safety
- 4. Personnel Radiation Protection
- 5. Safeguards and Security
- 6. Transportation
- 7. Value Basis Reporting
- 8. Facility Status
- 9. Nuclear Explosive Safety
- 10. Cross-Category Items

Severity of Occurrence

Severity of occurrence indicates the degree of significance associated with the different types of occurrences.

Unusual Occurrence: A non-emergency occurrence that exceeds the Off-Normal Occurrence threshold criteria; is related to safety, environment, health, security, or operations; and requires immediate notification to DOE.

Off-Normal Occurrence: Abnormal or unplanned event or condition that adversely affects, potentially affects, or is indicative of degradation in the safety, safeguards and security, environmental or health protection, performance, or operation of a facility.

Facility Function

Facility function identifies the type of facility or the activity/function performed by the facility. Possible facility functions are listed below.

- Plutonium Processing and Handling
- Special Nuclear Materials Storage
- Explosive
- Uranium Enrichment
- Uranium Conversion/Processing and Handling
- Irradiated Fissile Material Storage
- Reprocessing
- Nuclear Waste Operations
- Tritium Activities
- Fusion Activities
- Environmental Restoration Operations
- Category “A” Reactors
- Category “B” Reactors
- Solar Activities
- Fossil and Petroleum Reserves
- Accelerators
- Balance-of-Plant (e.g., offices, machine shops, site/outside utilities, safeguards/security, and transportation)

Causes of Occurrences

Causes of occurrences are determined by performing event investigations and may be identified as direct, contributing, or root causes.

- Direct Cause: The cause that directly resulted in the occurrence.
- Contributing Causes: The cause(s) that contributed to the occurrence but, that by itself, would not have caused the occurrence.
- Root Cause: The cause that, if corrected, would prevent recurrence of this and similar occurrences.

Cause categories are selected from the following:

1. Equipment/material problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.
2. Procedure problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or procedural deficiency or inadequacy.
3. Personnel error: An event or condition due to an error, mistake or oversight. Personnel errors include inattention to details of the task, procedures not used or used incorrectly, communication problems, and other human errors.
4. Design problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.
5. Training deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.
6. Management problem: An event or condition that can be directly traced to managerial actions or methods. Management problems include inadequate administrative control, work organization/planning deficiency, inadequate supervision, improper resource allocation, policies not adequately defined, disseminated or enforced, and other management problems.
7. External phenomenon: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.
8. Radiation/hazardous material problem: An event related to radiological or hazardous material contamination that cannot be attributed to any other causes.

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Product Improvement Survey Form

Purpose of the Product - The Office of Operating Experience Analysis and Feedback, EH-33, is developing a set of indicators for measuring the performance of DOE operations in the areas of Worker Safety and Health and the Environment. The indicators are intended to measure the Department's success in its strategic goal to manage and improve its environmental, safety, and health (ES&H) performance. The major customers for these indicators are expected to be the senior leadership of DOE.

In order to assess the effectiveness of this new performance indicator report, we would appreciate your assistance by providing responses to the following (check one):

1.	Do you use indicators to measure performance?	❑ Yes	❑ No
2.	Do you feel that improved methods for measuring performance are needed?	❑ Yes	❑ No
3.	Would you make management decisions based on this kind of information?	❑ Yes	❑ No
4.	Does DOE-wide ES&H performance matter to you?	❑ Yes	❑ No

5. What are your information needs with regard to measuring Department-wide ES&H success:

- ❑ Quick pulse of the Department ES&H success
- ❑ Light detail concerning the Department ES&H success
- ❑ Moderate detail concerning the Department ES&H success
- ❑ I have no need for this information on a regular basis

Report Evaluation - From your review of this report, ***and in consideration of the purpose stated above***, mark the number that most closely corresponds to your reaction to the following statements

		Strongly Agree			***Neutral***			***Strongly Disagree***
6.	The performance indicators are relevant to the measurement of overall DOE ES&H performance.	⑦	⑥	⑤	④	③	②	①
7.	The report layout (text and graphics) is logical and easy to understand.	⑦	⑥	⑤	④	③	②	①
8.	The data presented in this report are consistent with my impressions of DOE's ES&H performance.	⑦	⑥	⑤	④	③	②	①
9.	The performance indicators provide a "balanced" view (e.g., successes and problems) of DOE's ES&H performance.	⑦	⑥	⑤	④	③	②	①
10.	This report concept can help measure DOE's success in managing and improving its ES&H performance.	⑦	⑥	⑤	④	③	②	①
11.	This report concept can be useful in communicating information on DOE's ES&H performance to external customers.	⑦	⑥	⑤	④	③	②	①

12.	Would you be willing to expend time/travel funds to participate in product improvement sessions?	❑ Yes	❑ No
13.	Would you be willing to expend time/travel funds to participate in product improvement sessions?	❑ Yes	❑ No

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DOE Operating Experience Analysis
Safety Management Through Analysis

Page 1 of _____

From:

Name _____

Organization _____

Phone _____

Comments: What additional parameter(s) should be monitored and where could the data be obtained? Consider changes required to make this report more useful for your needs and any general observations based on your review. Use additional pages as necessary.